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★AUGUST 20, 1953.
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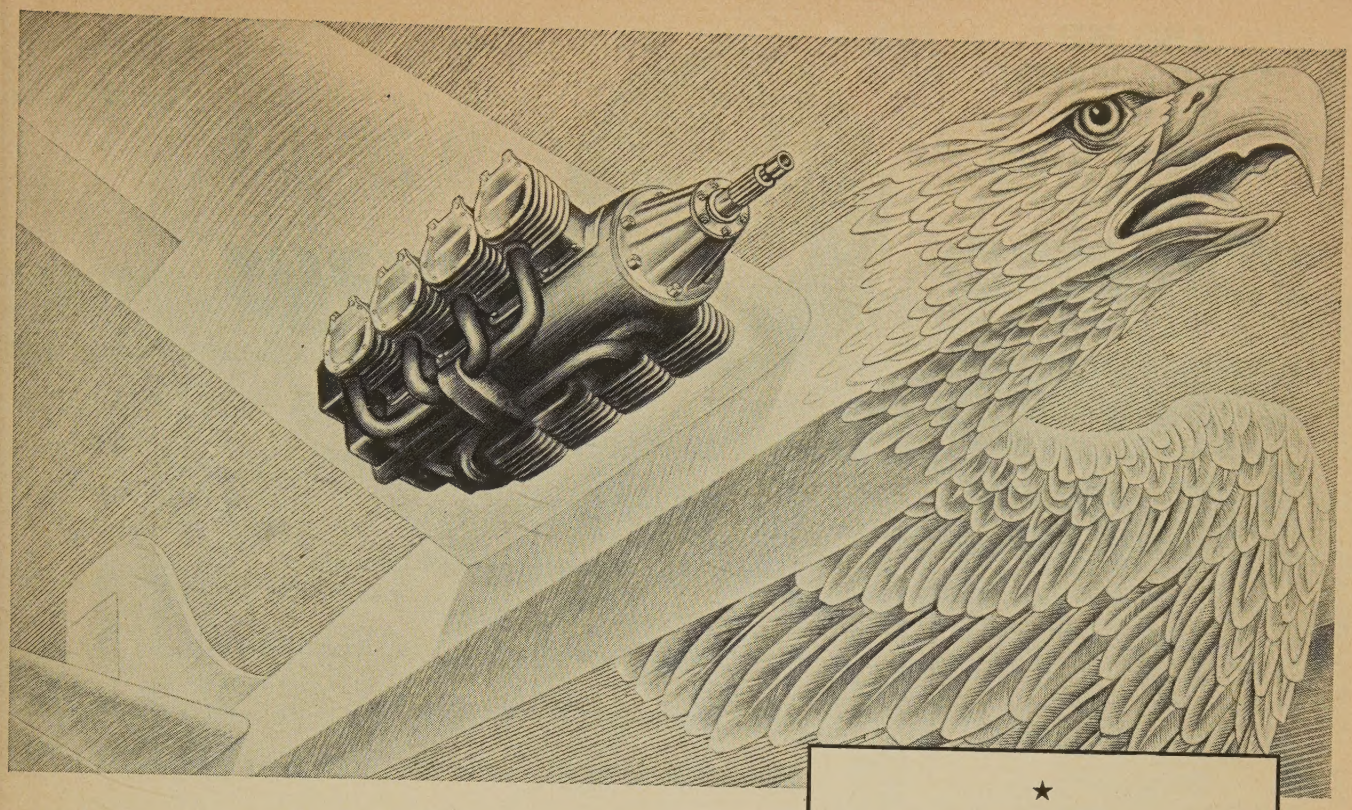
U.S. AIR FORCE



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150 HP RILEY TWIN NAVION CONVERSION

BY

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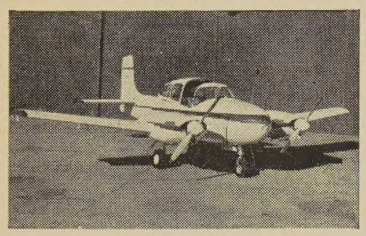

CASE HISTORY: #811-119-16

CUSTOMER: RILEY AIRCRAFT SALES CORPORATION
Fort Lauderdale, Florida

SHIP: RILEY TWIN N-88N
(Owned by Jack D. Barrett, Sherman, Texas)

RILEY TWIN Navion conversion at TEMCO-Greenville included removal of single engine, all interior furnishings, instrument panel and accessories. Installation of two 150-horsepower Lycoming engines with all-metal, full-feathering Hartzell propellers. Completely new instrument panel; floor-mounted pedestal with throttle, propeller and mixture controls. Reinforcement of center wing section; toe brakes; larger vertical stabilizer and complete new deluxe interior.

First of the new 150-horsepower RILEY TWIN Navion conversions, this more powerful version offers improved twin-engine performance... increased speed, smoother handling. These assembly-line conversions are now being performed at TEMCO-Greenville on Navions and 140-horsepower RILEY TWIN's.

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For full details on this case history and information about TEMCO's complete custom rehabilitation service for multi-engine aircraft, write to:

Herrol Bellomy, Gen. Supt., TEMCO Aircraft Corp., Greenville Overhaul Division, Box 1056, Greenville, Texas.

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JANUARY, 1954

Skyways

Flight Operations • Engineering • Management

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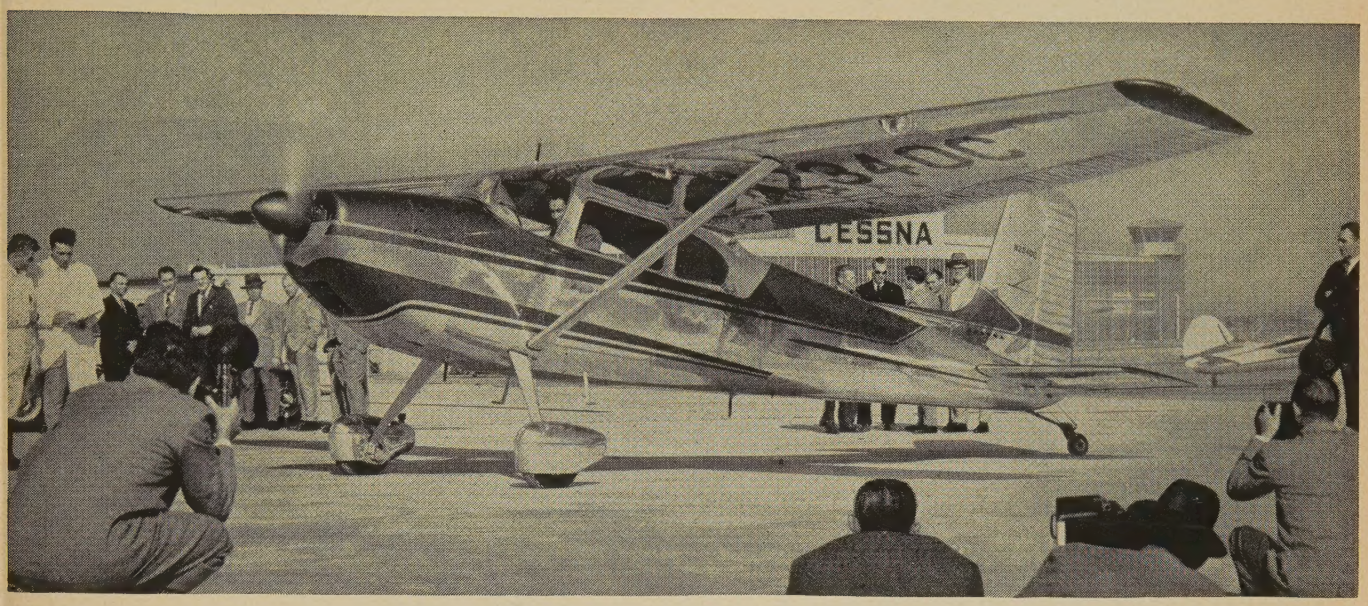
Top Performer... Now Proved and Improved

It's '54's "Smoothest" Airplane



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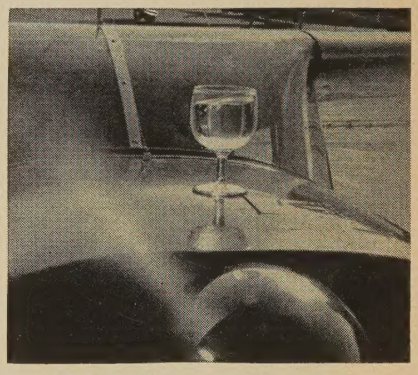

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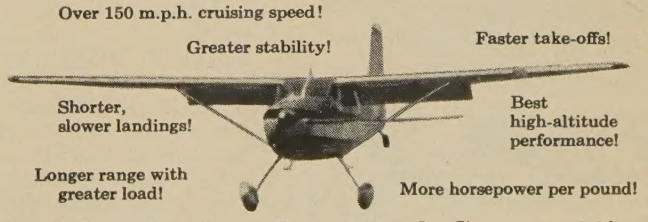

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PERSONNEL

William A. Patterson, president of United Air Lines, recently was elected to the Board of Westinghouse Electric Corp., New York.

W. D. Parker, Manager of Aviation Sales for Phillips Petroleum Co., has been elected Chairman of Aviation Technical Service Committee of the American Petroleum Institute's Division of Marketing.

Edward G. Littel was appointed assistant to the president of Vitro Corporation of America and affiliated companies. Mr. Littel has his offices in Washington, D. C.

Dale A. Lichty, vice president in charge of sales and engineering, Hydro-Aire, Inc., has been elected to the company's Board of Directors. **Leslie E. King** has been appointed a project engineer at Hydro-Aire, Inc.

J. C. Owen, former Senior Engineer in charge of Systems Engineering activities at Eclipse-Pioneer, has been named Chief Engineer, Instrument Products, of Lear, Inc., Grand Rapids Division.

Larry Eigenrauch was named as sales manager of Eclipse-Pioneer Division Foundries of Bendix Aviation Corp. **Willard Neuert** will take Mr. Eigenrauch's former position as production manager.

Nils H. Lou has been appointed chief manufacturing engineer at Republic Aviation Corp.

Walter A. Barthol, former zone manager at Los Angeles for AC Spark Plug, has been named Chicago Regional manager of AC Spark Plug division of General Motors Corp. He replaces **W. C. Lee** who has been elevated to headquarters staff in Flint, Mich.

George E. McKusick, formerly chief advisor of the N. Y. Int'l Office of the CAA, has joined the staff of Lockheed Aircraft Service as service salesman.

Carrol E. Rather recently was named purchasing agent of Southwest Airmotive Company at Love Field, Dallas.

Lee Talladay of Milan Michigan, was elected National President of the Flying Farmers.

Forrest F. Hinkley has been named Director of Subsidiary Operations, Aeroquip Corporation; **Horace B. Ferguson** has been named Director of Purchasing.

Kenneth G. Patrick recently was appointed manager of educational relations services in the Public Relations Services Division of General Electric Co. **J. Stanford Smith** has been named to Mr. Patrick's former position as manager of general public relations services. **Ralston B. Reid** replaces Mr. Smith as manager of advertising and sales promotion for G-E Apparatus Sales Div. at Schenectady.

Lynn Eaton has become vice president in charge of sales of the National Company, an electronics firm located at Malden and Melrose, Mass.

COMPANIES

Hamilton Standard division of United Aircraft Corporation has announced completion of its new laboratory facilities at Windsor Locks, Conn.

Canadian Pacific Airlines has ordered three *Comet* 2 jet airlines from de Havilland for delivery next Fall. CPAL has an option to purchase a fourth *Comet* 2 for delivery early in 1955.

Aerodex, Inc., Miami, has announced completion of its new Executive Aircraft Terminal at Miami International Airport.

Minneapolis-Honeywell Regulator Co., Aeronautical Division, is establishing a wintertime jet aircraft flight center at Tucson, Arizona. **T. U. Grove** will be in charge of the new Tucson center.

Aeronautical Electronics, Inc., located at Raleigh-Durham Airport (N. C.), has completed its reorganization and expansion program. **Betty Skelton,** well-known aerobatic pilot, has been appointed Secretary and General Manager of the corporation.

Bell Aircraft Corporation has announced the sale of three helicopters to the French government and a French Indo China air charter service.

AWARDS

Ralph S. Damon, president of Trans World Airlines, received the American Legion's Award of Merit for his contributions to aviation.

Col. Bernt Balchen, USAF; **Walter L. Massie,** chief pilot for Goodyear Aircraft Corporation; and **Jacqueline Auriol** of France were awarded the Harmon International Trophies.

C. R. Strang, chief project engineer at Douglas Aircraft, Santa Monica Div., was cited by the University of Michigan for his outstanding achievements and contributions to the field of engineering.

AERO CALENDER

Jan. 8-11—Eleventh Annual Miami-Havana Air Cruise.

Jan. 18-22—American Institute of Electrical Engineers. Winter Meeting. Hotel Statler, New York.

Jan. 25—IAS Honors Night Dinner. Astor Hotel, New York.

Jan. 25-29—Twenty-second Annual IAS meeting, Astor Hotel, New York.

Jan. 25-28—Plant Maintenance & Engineering Conference and Show. Hotel Conrad Hilton, Chicago.

Feb. 3-5—Society of Plastics Industry. Edgewater Beach Hotel, Chicago.

Mar. 22-25—Institute of Radio Engineers National Convention. Hotel Waldorf Astoria, New York.

Apr. 29-30—American Society of Tool Engineers, Convention Center, Phila.

May 5-7—Third International Aviation Trade Show. 71st Regiment Armory, New York.

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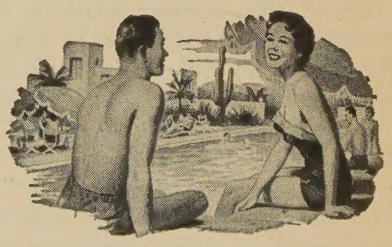

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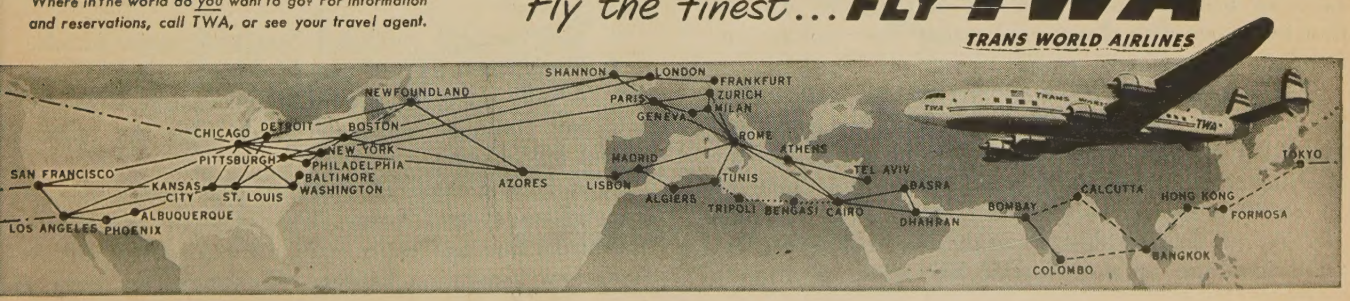


THE LEARSTAR

Lodestar conversion by Learcraft raises TAS to over 270 mph, increases range to 3,000 miles; all without additional horsepower

by Herb Fisher
Chief Aviation Development
Port of New York Authority

And there I was at 13,000 feet, cruising a *Lodestar* at a spectacular true airspeed of 286 mph and successfully concealing my surprise over this new git-up-and-go performance of the dependable, old twin-engine transport.

While you're trying to absorb that startling cruise figure, here are a few more eyebrow-raising facts and numerals recorded during the flight: Gross weight, 19,500 lbs.; manifold pressure, 30 inches; OAT, 6° C.; rpm, 2200; IAS, 226; fuel consumption, indicated rate of 106 gallons or 636 lbs. an hour.

These extraordinary performance specs for an aircraft which normally cruises in the 190-220 mph range were obtained *without additional horsepower.* The readings are for standard Wright 1820-56's.

However, there is no deep mystery about how I was able, without added power, to get that high cruise and such an economical fuel flow. For the airplane was the remarkable new "Learstar"—a *Lodestar* with an honor degree from the graduate school of Santa Monica's new No Drag U.

It is a *Lodestar* with a difference, the difference being spelled out in terms of increased aerodynamic efficiency and that, in turn, stems from painstaking attention to every item of drag, however small, on an airplane noted for its clean lines and surfaces. In short, the "Learstar" now flies with very little of its drag showing.

A product of the imaginative thinking and I-don't-know-what's-impossible attitude of William P. Lear, Director of Research and Development of Lear, Inc., and a Collier's Trophy winner, the "Learstar" has emerged as a twin which matches the best cruising speed of the fastest twin-engine airline equipment. Other results of the conversion include deluxe comfort, exceptional range, economical fuel consumption, and the ability to utilize small airports.

As a starting point for the conversion, the Lockheed *Lodestar* provided Lear with one of the safest aircraft ever built, one with clean aerodynamic lines and an outstanding performance record.

Bill Lear believed, however, that the full potential of the *Lodestar's* fine design had not been developed and that a higher level of performance could be obtained by applying to it the wealth of knowledge of drag compiled by research agencies since the *Lodestar* was designed. He also had definite ideas about the elimination of external bric-a-brac, or aerodynamic barnacles, on aircraft.

The conversion program was launched by attacking every external item which contributed to drag, but merely removing such things as antenna housings and masts was only part of the solution of the problem. To make certain that no area of drag would be overlooked in the task of refining the basic *Lodestar* configuration, Lear organized a scientific program of study to reach the desired objectives—higher speed and improved over-all performance without change in horsepower. He established Learcraft Conversions, Inc., at Santa Monica and staffed it with top caliber engineers and production experts. For example, the chief engineer of the project is Gordon Israel, pilot and designer who contributed to the design planning which evolved Grumman's F7F and F9F and the *Mallard.*

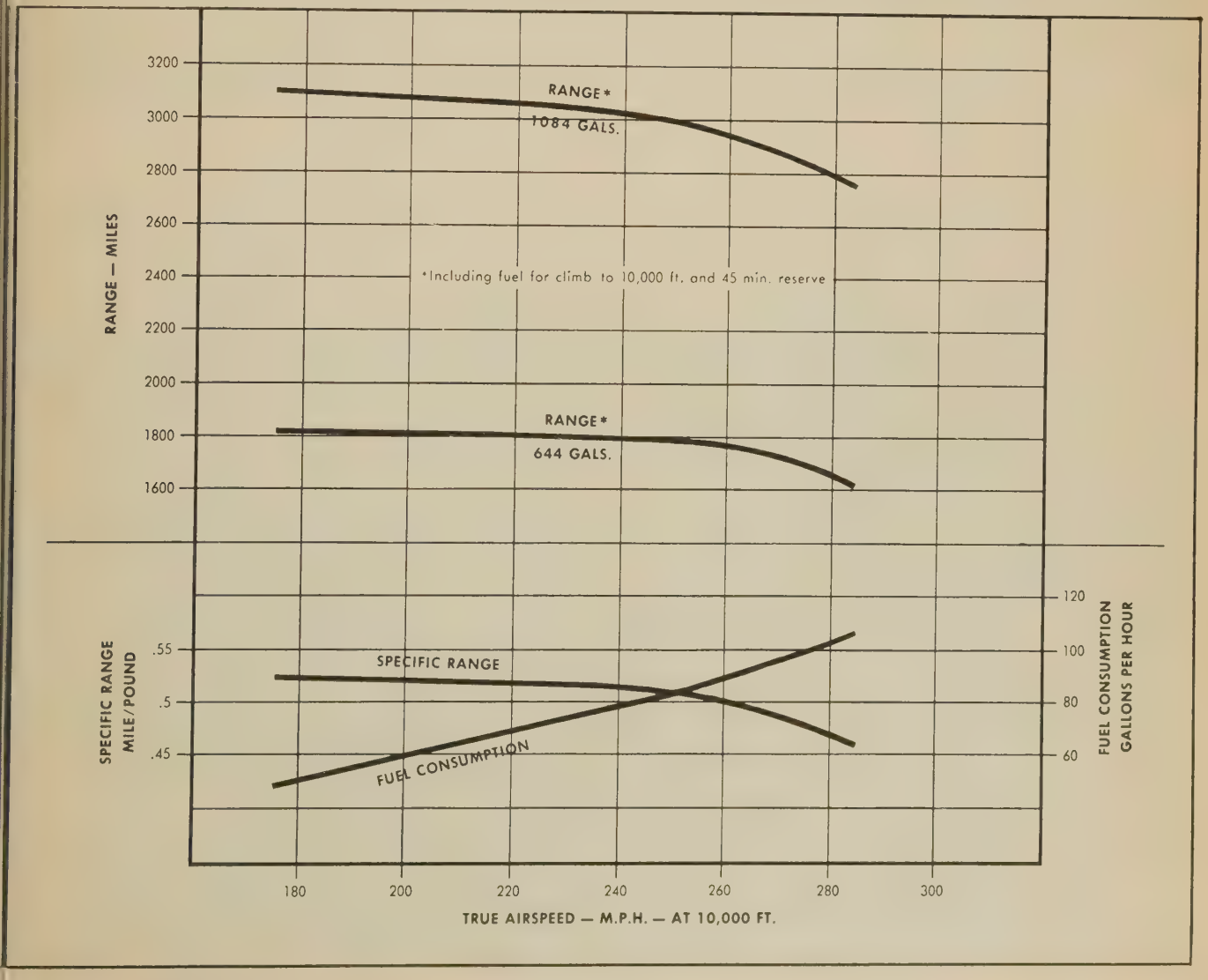
The details of the step-by-step modification of the *Lodestar,* from nose to tail and from wing tip to wing tip, will be found in the companion article in this issue by Don Dwiggins. As a pilot who worked closely with aircraft design, engineering and modifications for many years, I was keenly interested in each change in the "Learstar," but I was much more concerned with how those changes had paid off in improved aerodynamic performance.

I was introduced to the "Learstar" at Newark, N. J., and it was an impressive introduction. With Bill Lear as my guide, I walked around the airplane to study at close range the numerous drag reduction changes incorporated in the airplane. My list reads like this:

1. Modified "droop" tip wing, replacing the standard *Lodestar* wing slots and providing reduced drag and greatly improved stall characteristics. Reduced flap travel with "batwings" and external flap tracks removed and flaps modified to taper to a hairline feathered trailing edge, aiding in drag reduction and increasing wing area.
2. The increased angle of incidence of the horizontal stabilizer and the squared-off stabilizer tips, plus a new saddle on the fuselage contour forward of the stabilizer's leading edge.
3. New specially modified Goodyear main wheels.
4. Flush windows and new bird-proof windshield.
5. A fully retractable tailwheel, so designed that take-offs and landings cannot be made with the tailwheel swivel unlocked.
6. A new streamlined cowling, plus new augmentor-type exhaust system. A new, stronger engine mount moves the thrust line and entire nacelle three inches outboard. This new separation between *(Continued on page 41)*

GLIDE TEST *studies of Learstar, shown here with power off, both props feathered, were made to indicate propulsive proficiency of airplane*

CHART *indicates the projected performance of the Learstar. Note anticipated 2600-mile plus range with 1,084 gallons fuel, at 286 mph TAS*



Learstar Speed Conversion

Detailed drag study leads to complete rework of Lodestar airframe, and results in increased efficiency in power utilization, added speed and range

by Don Dwiggins

Flying business executives can now utilize America's thousands of small airports with airline economy through the amazing metamorphosis of a small World War II transport, cleaned up to modern performance standards by an airminded businessman who knew what price he was paying for that old devil drag.

Bill Lear, who built a highly successful enterprise manufacturing precision electronics and radio gear for airplanes, hated inefficiency with such a passion that he plunged headlong into a brand new business to do something about it.

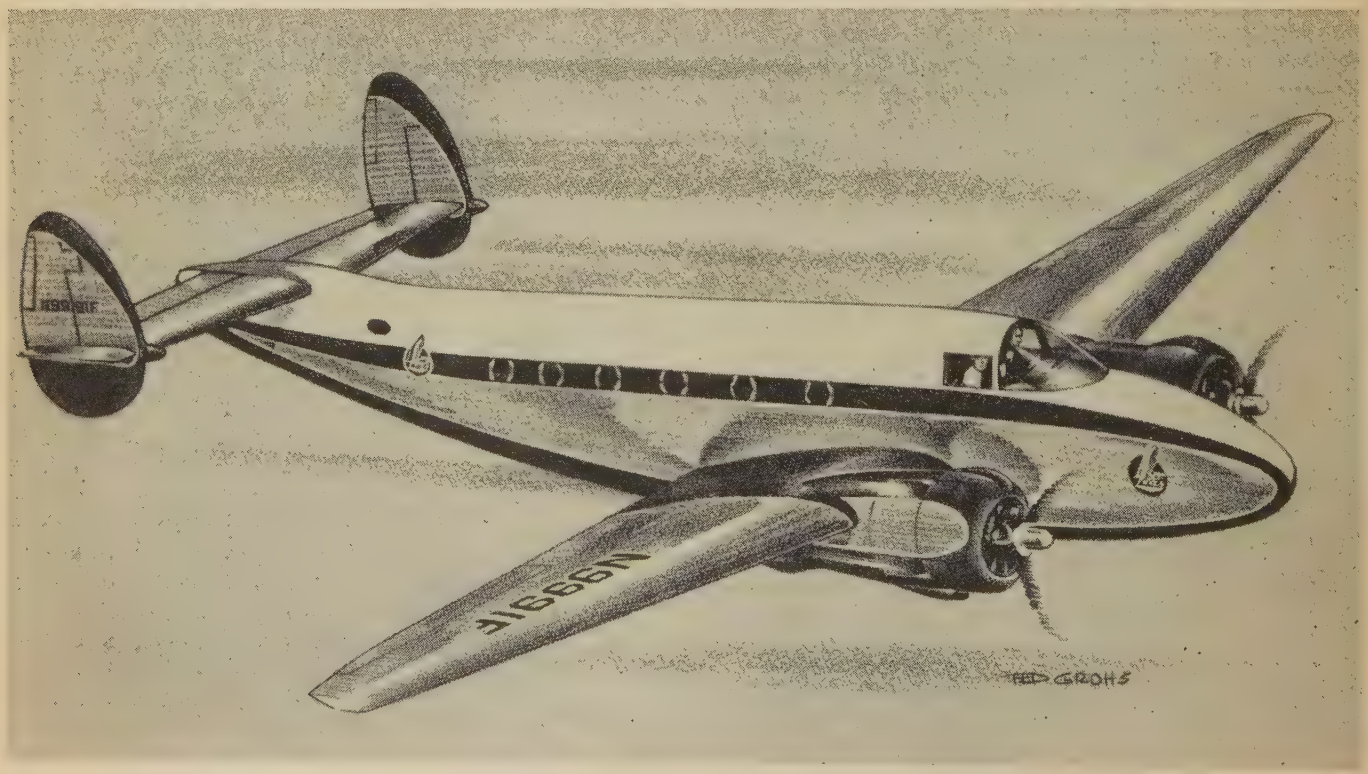
That something was a complete changeover of his loveable old personal Lockheed *Lodestar* to make it what he knew it could be—a sleek, efficient business ship that's entirely capable of airliner performance.

His Lockheed Model 18 *Lodestar* subsequently became the prototype for a new executive fleet being created by Lear through the investment of hundreds of thousands of dollars in research and development of the original *Lodestar* into what he fondly calls the "Learstar Speed Conversion."

This idea was the origin of Learstar Conversions, Inc., a subsidiary Lear company at Santa Monica Airport in Southern California, currently bossed by Division Manager Arthur W. Cruse.

Already Lear has six *Lodestars* under conversion in his new Santa Monica plant (including his own), with the first commercial job scheduled for delivery in January

ARTIST'S *drawing of Learstar in flight shows the aircraft after all modifications have been made. Note the new one-piece Sierracin windshield. The original Lodestar windshield had a broken contour line that accounted for considerable drag, while new one-piece windshield offers better visibility, less drag, greater strength and safety. Note, too, that all outside "clothesline" antennae have been eliminated to cut drag. ADF loops are hidden inside plastic fairing immediately ahead of horizontal stabilizer*



to Paul Butler, president of Butler Aviation.

Lear admits he isn't yet through with modifying the *Lodestar* into the "Learstar." He feels confident that the conversion ultimately will exceed 300 mph true air speed cruising on only 58% power at 10,000 feet.

Right now, Lear guarantees a cruise of 270 mph, or 50 mph faster than the design cruising speed of 220 mph specified for the original Model 18, first built by Lockheed in 1939.

However, the big thing about the "Learstar" is not the added speed—it is the amazingly increased efficiency in power utilization, brought about largely by a thorough rework of the entire airframe from nose to tailwheel.

Gordon Israel, Lear's chief engineer, describes the result this way:

"We flew the 'Learstar' at cruising speed side-by-side in formation with a standard *Lodestar*—same speed, same altitude, and discoyered that the 'Learstar's' endurance was 9 hours against 5 hours for the *Lodestar,* with the same quantity of fuel aboard."

That's the kind of performance that means something to a business executive who could become irritated on learning that his *Lodestar* (and other similar aircraft) operates at a propulsive efficiency of only about 40%!

Lear was definitely irritated when he learned from Dr. August Raspet, head of the Aerophysics Department of Mississippi State College, that 60% of his power was being wasted fighting unproductive drag, while only 40% kept the ship flying.

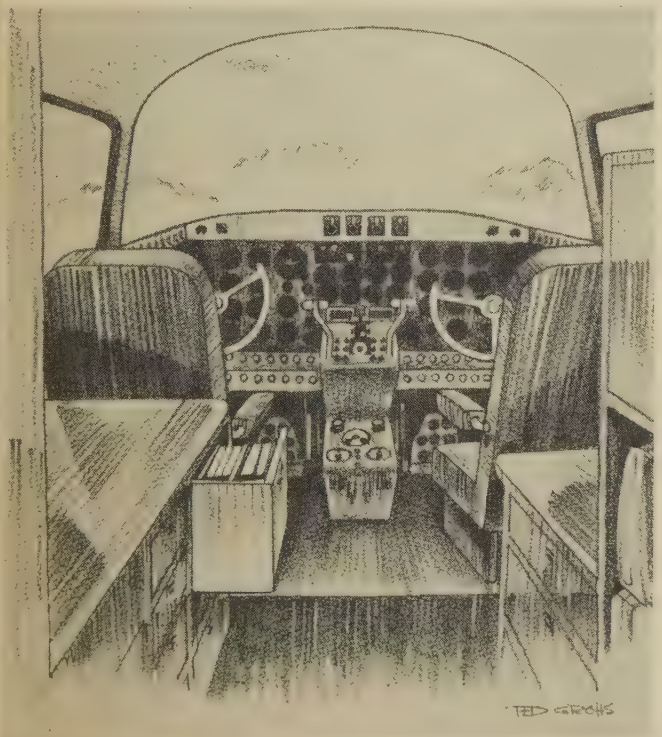
To digress a moment, it would be of interest to know how Dr. Raspet found out so much about drag, and how he helped Lear whip it.

WILLIAM P. LEAR *and Gordon Isreal (right) combined abilities to develop Learstar conversion which was the result of Bill Lear's desire to whip drag, and Gordon Isreal's ability to enginer Bill Lear's ideas into reality*

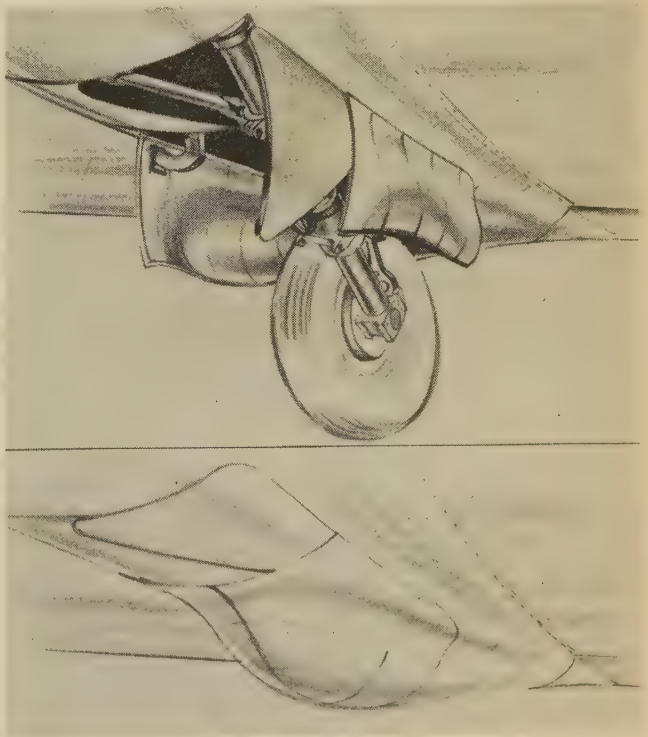
Dr. Raspet had developed a precise flight research method to evaluate performance of sailplanes (he cleaned up the RJ-5 with the help of R. H. Johnson to increase its glide ratio from 30 to 40, enabling Johnson to set a new world distance record for gliders of 535 miles).

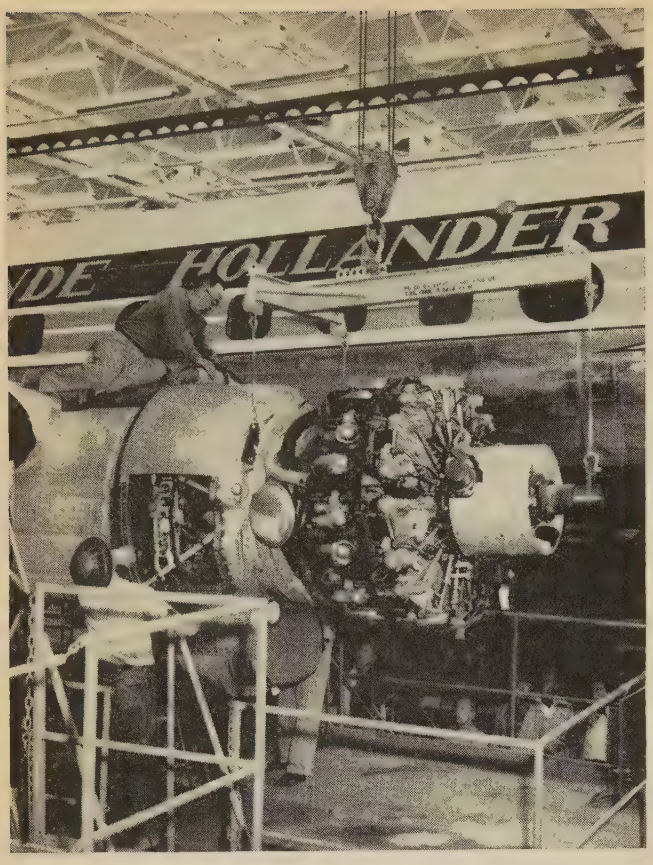
It involved, for the *Lodestar,* flying to 20,000 feet and gliding back to 10,000 feet, with props feathered, to determine the thrust horsepower required with and without Lear modifications (such as cowl flaps). This data was correlated with other data obtained in powered flight with torque noses and torquemeters on the engines, to determine over-all propulsion efficiency before and after each modification. *(Continued on page 36)*

COCKPIT *redesign for Learstar called for dropping front wing spar eight inches to provide flush cockpit floor, and removing bulkhead behind pilot seats. Note all switches, circuit breakers are on console apron; there are no switches or controls on ceiling*



FULL CLOSURE *of main landing gear is effected when gear is retracted. In addition to two principal "clamshell" doors, there is a third, smaller door which covers strut opening to provide completely faired condition; provides good increment of speed*





WRIGHT DA-1 *compound engine on 1049C offers 3250 bhp at 2900 rpm; C18CB engine on 749 model offered 2800 bhp at 2900 rpm*

KLM's Super Constellation

Royal Dutch Airlines' experience with new Super Constellation powered by turbo-compound engines indicates increased performance, operating efficiency will answer airline needs for years to come

by Edward A. Driessen
Director of Research, KLM

In the early afternoon of June 29, 1953 the first giant Lockheed 1049C *Super Constellation* delivered to any airline touched down on the main runway of sun-lit Schiphol Airport at Amsterdam, center of activity of KLM Royal Dutch Airlines, the oldest airline company in the world.

Though externally the *Super Constellation* with Wright DA-1 compound engines bears a strong family resemblance to the older types of *Constellation*, the interior of the new aircraft, as designed by Henry Dreyfuss, is the latest word both in passenger appeal and in operational efficiency.

The stretched-out fuselage, 18 feet longer than that of the old Connie, is divided into seven separate compartments: the cockpit, the crew compartment, front cabin, main cabin, lounge, pantry and aft cabin.

COCKPIT: The cockpit provides ample working space for the normal KLM crew complement on duty: captain, first officer, flight engineer and radio operator. The cockpit windows are electrically heated Nesa panels, 3½ inches higher than in the 749 to improve cockpit visibility.

The pilots' instrument panel in the *Super Constellation* is laid out according to KLM's own specification which also is used in their DC-6B's and Convair 340's. Apart from normal flight instruments, the instrument panel includes a Sperry Zero Reader. This Zero Reader, the improved cockpit view and the installed provisions for the automatic approach system on the PB-10 auto-pilot combine to enable KLM's *Super Constellations* to operate with very low weather minimums.

Instrument lighting is provided in white and red, to be used and controlled at the pilot's discretion.

The flight engineer faces the starboard side and has complete engine controls and instrument panels, including the Sperry ignition analyzer, which has been in use with KLM for about a year and which has proved a valuable aid in airborne trouble-shooting.

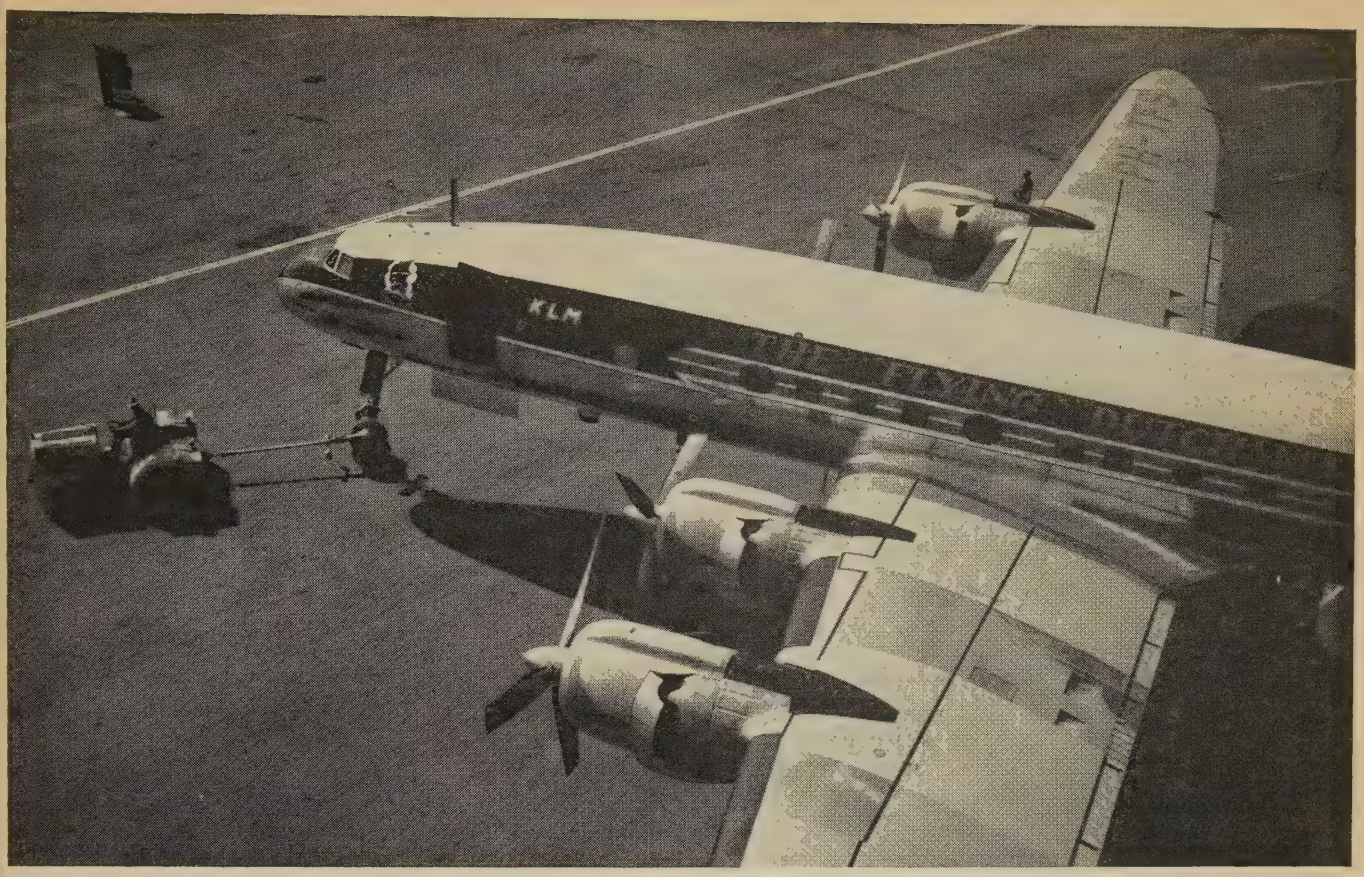
CREW COMPARTMENT: For long-distance flights, rest facilities for off-duty crew members are mandatory. In the L-1049C, these crew members are provided with four seats on the starboard side of the plane, separated by partitions from both the cockpit and the cabin. The four seats may easily be converted into two beds.

On port, a spacious folding table is provided for navigation and administration duties. The table may be stowed in order to give sufficient room to allow freight loading through the forward door on the left-hand side of the airplane.

FRONT CABIN: This cabin, forward of the propeller plane, allows 12 Standard or 15 Tourist passengers to enjoy the good visibility provided by ample rectangular windows. This cabin may also be used for freight loaded via the crew compartment door, and for which purpose the floor has been especially reinforced.

MAIN CABIN: Separated from the front cabin by two lavatories, the main cabin provides space for 32 Standard or 40 Tourist passengers.

LOUNGE: A spacious lounge with seats for eight passengers is separated from the main cabin by plastic windows with decorations designed by Dutch artists. The low-slung luxury seats and the schematic world map



LOCKHEED 1049C, *now in fleet use on KLM routes to New York and to South Africa, is 18 feet longer than the Model 749. Cockpit windows are electrically heated Nesa panels, 3½ inches higher than those in 749 to improve cockpit visibility. L-1049C is approved for operating with either Curtiss 830, or the new 858, and Hamilton Standard props. KLM recommends an approach speed of 150 mph and 130-mph "over the fence", compared to 130 and 115 mph for 749. New 1049C is more stable than the 749*

painted on the walls in soft colors will no doubt be a selling point for the passengers on long-distance flights.

PANTRY: The pantry is situated opposite the main entrance door and may be shut off by a curtain when not in use. The pantry was designed by KLM and manufactured by the Royal Dutch Aircraft Factory, Fokker. The neatness and efficiency of its design have induced other *Super Constellation* buyers to order similar pantries in Holland; they will be in use on the planes of Trans Canada Airlines, Qantas, Air India International, Pakistani International Airlines and the Spanish airline, Iberia.

AFT CABIN: The aft cabin provides space for another 11 Standard passengers, with toilet facilities for ladies and gentlemen at the far end.

The easy convertibility and the three separate passenger cabins of the Lockheed *Super Constellation* enable KLM to adjust the interior in accordance with the wishes of its passengers. The plane may be carrying three classes of passengers (Sleep-Air, Standard and Tourist) on one flight, and so eliminate the possibility of having to make an unprofitable flight when the number of passengers in any of these three classes would be low.

Performance

TAKE-OFF AND LANDING: The *Super Constellation* is approved for operating with both the Curtiss 830 propeller blades as well as with the new Curtiss 858. KLM uses the 830 blades on the L-749 now, but is the first operator to use the 858 extruded steel blades. It is expected that these stronger blades will show superior useful life, but experience so far collected is still too small to confirm this in actual practice.

Due to the higher weights of the *Super Constellation* (gross weight 133,000 lbs., landing weight 110,000 and zero fuel weight 100,000 lbs.) take-off and landing speeds are higher than for the old Model 749. Installation includes an automatic feathering system which, upon engine malfunctioning on take-off, selects the engine and feathers the propeller without the pilot having to distract his attention from the take-off maneuver. A warning light glows when an engine has been feathered.

Gear-retraction speed limit has been increased from 170 mph on the L-749 to 190 mph on the L-1049C. KLM recommends an approach speed of 150 mph and 130 mph "over the fence", compared with 130 and 115 mph for the L-749. Normal approach flap setting is 66%, though it is possible to use 80% as on the old Model 749. The aircraft is definitely more stable than previous *Constellation* models due to the increased tail surfaces and longer fuselage, and its stalling characteristics are considered excellent.

CLIMB: For climb with less than 125,000 lbs gross weight, KLM uses maximum cruise power, similar to the procedure for the L-749. This results in reduced cabin noise level and increased engine life. Only in the high weight brackets "alternate climb power" (2080 bhp at 2600 rpm) is used, which power is in between maximum cruise and METO.

CRUISE: Normally all KLM *(Continued on page 43)*

The Wilcox "CAT"

Computing Automatic Tracker improves on functions of ILS indicator system; tells pilot where he is going with reference to localizer beam, instead of where he is

by Capt. L. Homer Mouden
Braniff Air Lines

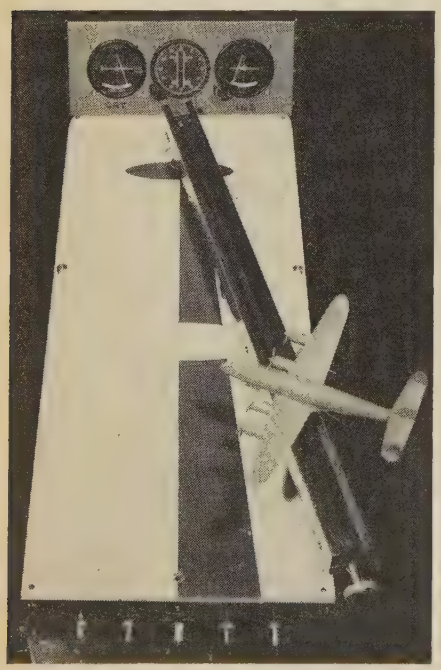
A relatively simple, inexpensive device was recently made available to the public. This is Wilcox Electric Company's Computing Automatic Tracker, popularly known as the "CAT". It was developed in cooperation with Eastern Air Lines and has been flight tested by EAL for the past 2½ years.

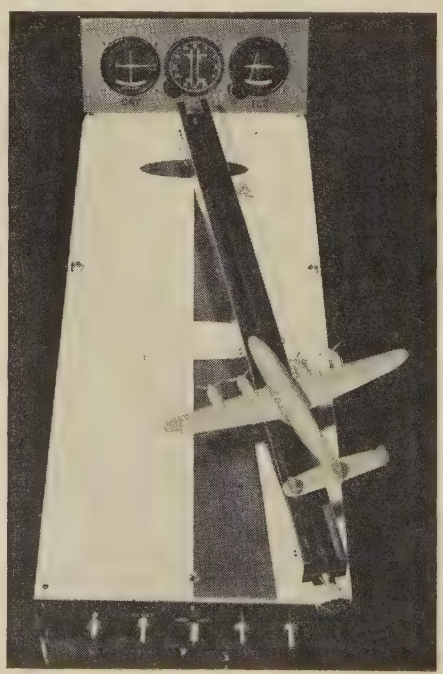
The Computing Automatic Tracker (CAT) assembly consists of a Computer Unit, a Runway Selector or a modified Omni-bearing Selector, a CAT test switch, and a CAT momentary release switch located on the pilot's wheel. The system also requires the use of a standard localizer receiver, the vertical needle of a deviation indicator, and a stabilized compass (such as a flux gate or Gyrosyn).

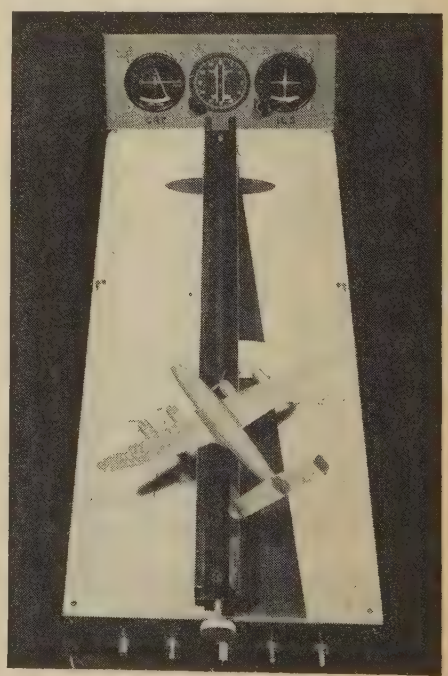
The OBS (Omni-bearing Selector) is modified by the addition of a small synchro, which is connected to the magnetic-heading synchro in the airplane's flux gate compass. This combines the signal normally received by the OBS with that from the airplane-heading sensing unit. The resultant of these two signals is fed to the vertical needle of the ILS indicator. Thus, when the runway bearing, in degrees magnetic, from the ILS localizer transmitter has been set into the OBS, its synchro produces a signal proportionate to the difference between the ILS runway bearing and the heading of the airplane. This signal in turn activates the ILS localizer indicator.

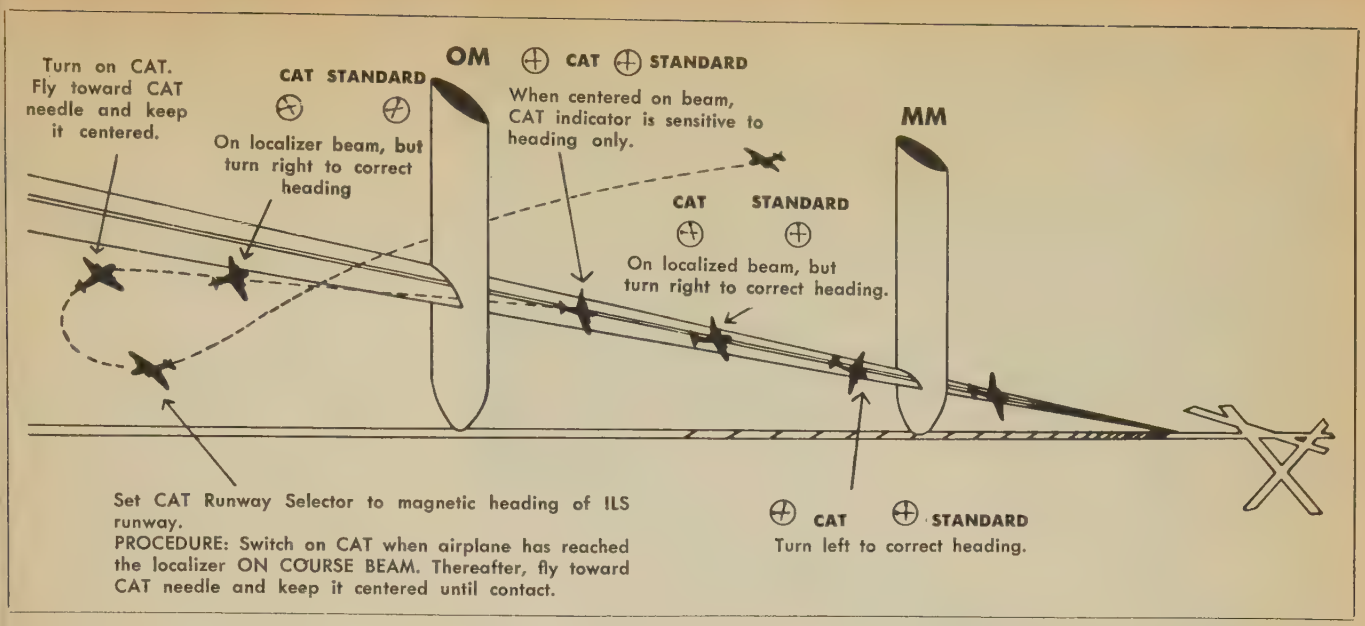
The DC signal from the localizer receiver is converted to pulsating DC, which is amplified and fed into a phase-sensitive rectifier circuit of the computer. This circuit combines the localizer signal with the heading-displacement signal received from the modified omni-bearing, or runway, selector. The vertical needle of the deviation indicator is then actuated by the combined signals of airplane heading displacement and localizer beam position.

When the airplane is on the localizer beam, the localizer off-course signal is reduced to zero, and the phase-sensitive rectifier circuit in the








Turn on CAT. Fly toward CAT needle and keep it centered.
CAT STANDARD
On localizer beam, but turn right to correct heading
OM
CAT STANDARD
When centered on beam, CAT indicator is sensitive to heading only.
MM
CAT STANDARD
On localized beam, but turn right to correct heading.
Set CAT Runway Selector to magnetic heading of ILS runway.
PROCEDURE: Switch on CAT when airplane has reached the localizer ON COURSE BEAM. Thereafter, fly toward CAT needle and keep it centered until contact.
CAT STANDARD
Turn left to correct heading.

computer is then sending to the deviation indicator only the heading displacement signal. Thus, when directly in the center of the localizer beam, the vertical needle will be sensitive to changes in airplane heading only. For every position off the localizer beam there will be one airplane heading that just neutralizes the localizer off-course signal, and permits the vertical needle of the CAT indicator to be centered. This is the proper heading to return the airplane to the center of the localizer beam.

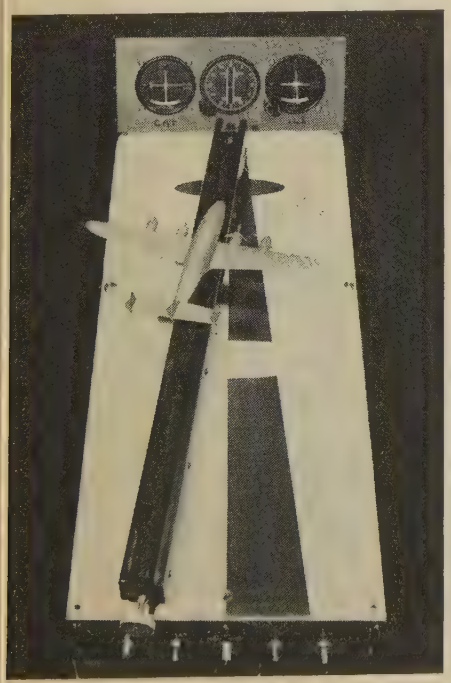
Without a localizer signal fed into the CAT, the vertical needle of the deviation indicator acts as a sensitive heading indicator, *i.e.*, as long as the airplane remains on the heading set on the bearing selector, the needle will remain centered and any change from this heading will be indicated by deflection of the needle.

When the airplane is beyond the outer marker, the localizer beam is broad, so relative change in signal phasing is less. At this point the CAT will be most sensitive to the airplane's heading, and less sensitive to the airplane's position relative to the localizer beam. In close to the end of the runway, the localizer beam is narrow, the localizer signal will predominate, and the CAT will be more sensitive to position on the localizer beam and less sensitive to airplane heading.

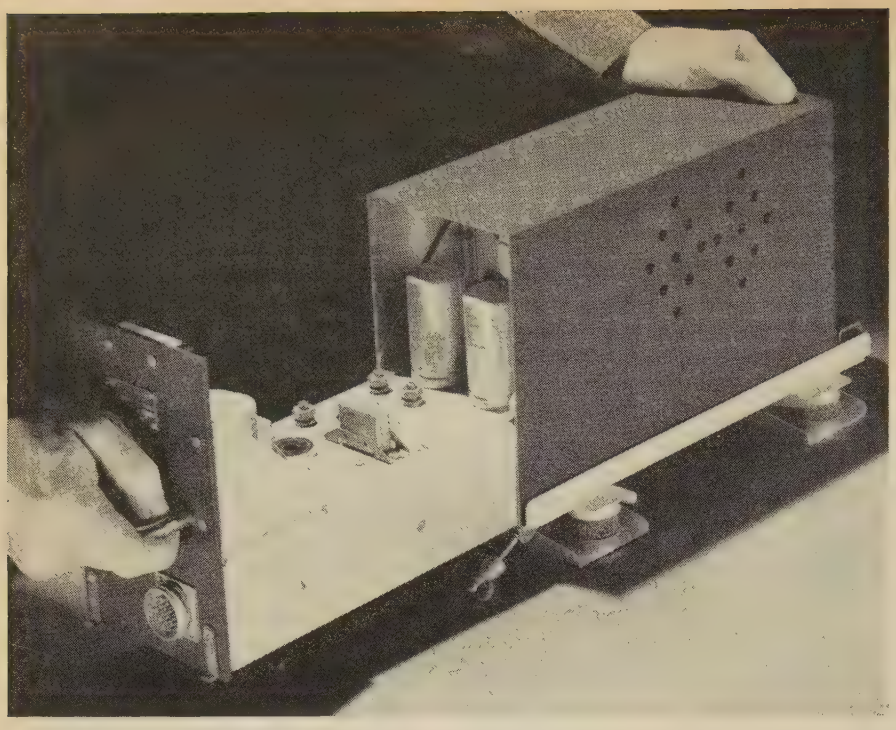
The CAT is adjustable for the type and speed of aircraft in which it is installed. In a zero crosswind condition, the needle will always be centered when the airplane is on the localizer beam, and the airplane heading is the same as the ILS runway heading as set on the omni-bearing, or runway, selector. In a crosswind, keeping the needle centered will establish the proper crab angle for the airplane, but since the computer can't think, it will track the localizer beam slightly downwind. In a known crosswind, the CAA approved procedure includes setting the OBS course into the wind by one-half the anticipated drift angle. For example, at MKC, with a runway bearing of 184° and a strong wind from 250°, resulting in a drift angle of 8°—set the Omni-bearing Selector 4° into the wind, or 188°. This keeps the heading correction to a minimum for landing after becoming contact.

The CAT utilizes the one basic bit of information that is needed to successfully fly any desired course or radial—the heading of the airplane. Any bearing or track can be flown if the airplane is headed in exactly the right direction to make good the desired course with compensation for all variable factors. While this is a fundamental rule of flying, it is nevertheless one of the most difficult things to accomplish. The degree of accuracy required for enroute flying is rather small, but when crossing the middle marker with a strong, gusty crosswind on an ILS approach, it has been known to exceed the pilot's capabilities.

The ILS needle has been aptly called the "post-mortem indicator". It tells the pilot what has happened rather that what is about to happen. Consequently, the pilot also has to take information from other instruments and translate it into expectations of what is about to occur.



DYNAMIC DEMONSTRATOR *(series of photos, left) illustrates relative information furnished by CAT and standard ILS. Photo 1 (far left, page 14) simulates plane approaching localizer beam. CAT needle shows beam still to be on left. In Photo 2, plane heading has been corrected for proper intersection as shown by CAT. Photo 3, the airplane continues on same heading as in Photo 1, and even though on the beam, as shown by ILS needle, it will need to turn right until CAT needle is centered to again properly intersect the localizer beam, as shown in Photo 4*



WILCOX CAT UNIT, *used to track ILS and to make instrument approaches easier, weighs only 8 lbs. In this photo (unit partially out of dust cover), RCA tubes have been removed*

Pilots have turned off course into mountains, made wrong turns that appeared to be completely foolish and unexplainable, and have been victims of errors that are only secondarily of their own creation. The primary reason for these may well be the fact that the instrument panel of any modern airplane—be it a *Navion* or a *Constellation*—is a complex assembly of many units. A pilot can utilize the information furnished by the various instruments only because he is able to read them at a glance as *normal* or *abnormal* indications.

Most of the instruments on the panel are read every few moments to determine whether the angular position of the various needles and hands is normal. All instruments are angular-position reading except the one instrument that furnishes direction information—the directional compass, or one of its remote reading components. Head temperature, rpm, manifold pressure, or almost any other information is furnished to the pilot through the angular position of the needle on the instrument. There is one make of magnetic compass that gives directional information through the angular position of a pointer on the face of a compass dial. However, the large majority of pilots receive the heading information through reading the numbers on a compass card. An aircraft compass gives no relative position information, but rather shows a number which is interpreted in relation to a direction. The information is relayed through the eyes to the brain, which must first interpret what the eyes have seen and then decide what is to be done with the information to accomplish the desired result.

Consider the confusion that can momentarily result when seeing the numbers 3, 33, or 30 on a compass. In making an ILS approach, a pilot can make a wrong compass heading correction without being aware of it until the airplane starts to move off the localizer beam.

With the correct ILS runway bearing set into the bearing selector, the Wilcox Computing Automatic Tracker (CAT) will immediately give the pilot, by means of *angular displacement,* an indication that he is going to change his position on the localizer beam unless a correction is soon made. The value of advance information, rather than "post-mortem" information, becomes increasingly great as the airplane moves down the ILS localizer, and the resultant beam becomes increasingly narrow.

The ILS deviation indicator shows angular displacement in relation to the centerline of the beam. If the airplane is 500 feet from the centerline at the outer marker, the angular displacement from the centerline heading is approximately 1°, while at the middle marker, the same distance off the centerline would be an angular displacement of almost 10°.

Like all pilots, after having looked the "gadget" over and had it explained, I wanted to fly with it, and to see it function. Mr. Jay V. Wilcox, president of Wilcox Electric Company, invited us to take his Twin Beech, on which a unit is installed, and give it a thorough workout. (Incidentally, Mr. Wilcox has flown over 600 hours in the Twin Beech and his Beech *Bonanza* in the past 2½ years, holds multi-engine and instrument ratings, and is well able to appreciate a pilot's needs for instrument flying.)

After Bill Tabor, Wilcox's genial demonstrator and flight test pilot, checked me out, we attempted to give the CAT a thorough flight evaluation. Bill demonstrated its use as a "lazy man's" aid in maintaining the desired heading as set up on the OBS, for flying the VOR ranges. Any change in airplane heading was quickly noticeable by the deflection of the needle on the deviation indicator without having to first drift off course to get a deflection.

It was a gusty, windy day but, unfortunately, the wind was from the north and all simulated ILS approaches had to be made downwind and against departing traffic. After five attempts we had passed the middle marker only once before having to abandon the approach. By this time, however, I was familar with the use of the CAT.

I wanted to try out the CAT for flying the ILS right down to the runway threshold, where the flying really becomes critical—but we decided that was out of the question at that time.

A few days later Donald Busse, the sales manager of Wilcox Electric Company, arranged for us to fly again. This time I asked Bob Harris, Assistant Chief Pilot of Braniff, to accompany me. While he was trying out the CAT, I would get an opportunity to watch it, the standard ILS indicator, the airplane heading, and the runway alignment. This would permit a close comparative check which couldn't be done while flying the airplane.

This time we had excellent test conditions in that we had a gusty, variable crosswind and we were

(Continued on page 44)

Pictorial vs. Symbolic Indication

Study suggests that if data presentation closely simulates visual information, pilot training time can be reduced

by LCDR George W. Hoover, USN

Paramount to the development of presentation of flight information is the decision as to whether the indication should be pictorial or symbolic. Those favoring symbolic presentation state that symbols are less complicated to build and, therefore, less expensive both in dollars and pounds. They further indicate that a pilot can fly more accurately by matching pointers than by any other method. The pictorial backers, however, feel that although these statements are true, there are more advantages to be gained by replacing these symbols with *more natural* presentations. Let's take a look at the problem and judge it by actual facts, rather than personal opinion or past history.

First of all, let us define the two terms clearly in order to prevent any misinterpretation.

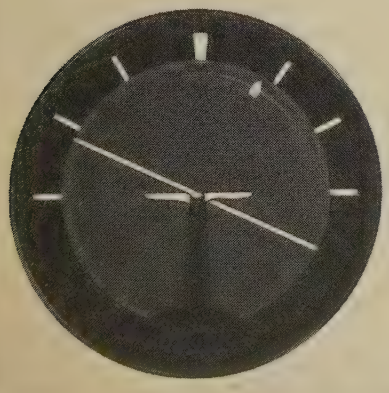
Symbolic instruments are those which present data by means of bars, pointers, circles or other geometric shapes moving with respect to some index to represent position, displacement, or rates of change. With very few exceptions, all instruments in present-day aircraft are symbolic.

Pictorial instruments are those which present data by a natural or synthetic reproduction of the visual cues experienced when flying contact. An instrument panel equipped with pictorial presentation would require a minimum of symbolic indication, mostly for rate information—rate of climb, rate of turn, etc.

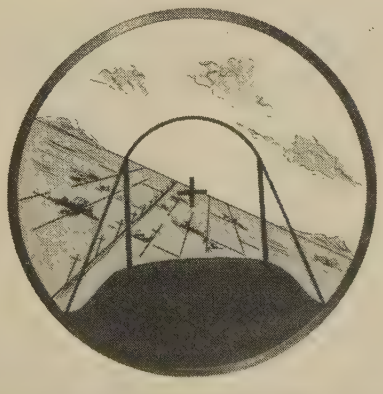
The history of our present instrument panel shows that it started with very few instruments. The early panels usually included a tachometer, an oil pressure gauge, a compass, a fuel gauge and in some instances an altimeter. These early instruments were "borrowed" from developments of the automotive industry and, at that time, were sufficient to handle the problem of supplying the pilot with required information. As aircraft and engines advanced, however, the need for more data became apparent and new techniques were discovered to supply such information as airspeed, rate-of-turn, direction, rate-of-climb, etc. All of these instruments followed the same basic pattern of a pointer rotating with respect to a fixed dial, with one exception—the artificial horizon. Here was the first approach to pictorial presentation.

Even in the early stages of instrument development the engineers were trying to reproduce a picture of the ground and sky. Some of the first models even included a background painted blue for the sky and black for the ground. Why this approach was discontinued is hard to say. Perhaps it was easier to actuate a single bar for the horizon; perhaps it was because pilots felt that they didn't need this background reference. At any rate, what started out to be a pictorial horizon developed into a stabilized bar representing the horizon. The development of the horizon from that point on has been quite progressive in the actuating mechanism but *(Continued on page 39)*

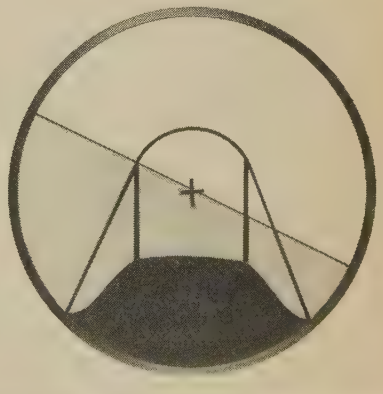
ATTITUDE



SYMBOLIC



PICTORIAL



COMPROMISE

Problems in Winter Operation

Discussion discloses in-flight problems subordinate to ground handling problems, recommends direct dispatch of aircraft from hangar

A. E. ADES, *Moderator of the discussions, joined TCA in 1939; became Asst. Director of Engineering in 1948. He is member of Institute of Aeronautical Sciences; is presently chairman of Montreal Branch.*

Chairman A. E. Ades *(Asst. Director-Engineering, Trans-Canada Airlines):* "We are here today to discuss experiences in cold-weather operations in the hope that these experiences may be of help to those aircraft operators who are planning to extend their lines into northern climates, and to those aircraft manufacturers designing aircraft to operate in that type of climate.

"One of the factors in cold-weather operation that probably has been less appreciated and less understood than any other, is the effect of wind and chill. We have tried to define cold weather by degree-day and various other methods, and have come up with the effect of wind and temperature together. Col. Balchen, would you tell us some of your experiences with the effect of wind-chill and what it means?"

Col. Bernt Balchen *(Operations Planning-Arctic, USAF):* "Wind chill is a factor derived from the amount of heat taken away from a certain unit of surface in a given time, as a result of wind and temperature. From these combined factors—wind and temperature, we have constructed a set of curves which we call wind-chill curves. These curves give definite values—so many gram-calories per hour taken away from the body. These measurements of the amount of cold experienced by both human beings and machinery are very important in determining our operational capabilities."

A. E. Ades: *"To get into the subject of the effect of wind-chill and temperature on equipment, Mr. Cahill, would you tell us of some of your experiences concerning structural problems associated with cold-weather operations?"*

Capt. Blake Cahill *(Engineering Pilot, Northwest Airlines):* "Most of our problems that are associated with cold-weather operations are on the ground. Once we get into flight, the troubles tend to clear themselves. Weather conditions that exist from Minneapolis west are somewhat different from the conditions that exist in other parts of the country. For example, restrictions to visibility to us may be blowing snow instead of some other visibility restriction considered by others to be more serious. It's sometimes hard to find people sympathetic with our ideas on approach systems, for instance, because they think of restricted visibility as being associated with fog or a low stratus condition. Actually, we may be experiencing visibility restrictions and also have turbulence or a lot of crosswind.

"We also find that the efficiency of the ground personnel goes down in cold weather. Their hands get cold, and baggage-door catches, gas caps, etc. that are handled in a routine manner without gloves and with warm hands become a problem.

"The operation of ground equipment also becomes a problem. Sometimes instead of using one heater to warm something on an airplane, we have to use two; one heater to heat the other.

"We also are continually having to develop new techniques for ground de-icing and ground snow clearance on the aircraft. Within a certain range of temperatures, snow may not stick to an airplane; but then within another range of temperatures, it may stick badly. One time you may be able to get the snow off by washing it off with glycol; another time we may have to put the airplane in the hangar, dry it off and then cool the hangar before we tow the airplane outside again so that it doesn't refreeze.

"You just can't set down any hard and fast rules in winter operations. You have to depend on user experience, and each particular case is different. You have to fit the rules to the circumstance."

Jerome Lederer *(Dir. Flight Safety Foundation):* "From Col. Balchen's remarks I gather that it is the rate at which you lose heat that is important; that aside from low temperatures, the wind is a definite factor. That being the case, protection from the wind must be very important. Does that mean that in the northern latitudes, you have to have shields to keep the men from being exposed to the wind?"

Capt. Cahill: "We do have to use nose hangars and portable engine-work covers for such things as engine changes that have to be done out on the field. Normally, the best answer to that problem is to keep your stops on the ground at a minimum and for as short a time as possible. The ground crew should be organized so that the airplane is in and out as quickly as possible."

Roy A. Holt *(Service Engineer, Northwest Airlines):* "You have to be brought up in the northern country to appreciate the little things that tend to make work easier for you. Wind break is one of the essentials; and a Herman Nelson heater will help your cause along. However, as far as cold weather is concerned, that doesn't present as much of a problem to us as sleet and ice, the factors Capt. Cahill mentioned earlier.

"We have the problem of critical temperature within a range of 25° and 35°. We can't depend strictly

PARTICIPANTS *at "Problems in Winter Operation" Round Table were (left to right around table) Capt. Steers, Northeast Airlines; Wheaton W. Mies, Northeast Airlines; D. F. Coyne, Flying Tiger Line; F. H. Stedman, Esso Standard Oil, who served as an observer; T. J. Healey, American Airlines; Cmdr. Weatherup, USN; J. H. O'Neill, Colonial Air Lines; T. D. Allegretti, Colonial Airlines; Capt. B. Cahill, Northwest Airlines; R. A. Holt, Northwest Airlines; R. L. Stacy, TWA; R. T. Peters, TWA; Capt. J. O. Eischeid, TWA; A. E. Ades, Trans-Canada Airlines, who served as Moderator of the meeting; Col. Bernt Balchen, USAF; James E. Conner, Pan American World Airways, Pacific Alaska Division; and Jerome Lederer, Director of Flight Safety Foundation*

on weather bureau statistics as far as temp or wind velocity are concerned, because the location of the airplane in relation to buildings has a bearing on the wind velocity.

"Temperatures in the neighborhood of 27° to 32° are the ones that give us the most trouble. To keep snow and ice off the plane, we've resorted to the fruit-growers' tree-spraying equipment, the Hudson Sprayer. As Capt. Cahill said, occasionally we have to dry a plane off in the hangar. After we've done this, we use the Hudson Sprayer to spray an 80% glycol solution on the plane. With a good coat of that, an airplane usually can get off the ground before the precipitation starts to re-freeze on it." *(Continued on Page 20)*

JANUARY 1954

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Wings Club
New York, N. Y.

COL. BERNT BALCHEN, famed Arctic flyer and chief, Operations Planning—Arctic, USAF, was one of 1953 recipients of Harmon Trophy.

CDR. R. A. WEATHERUP, head of Mechanical Equipment Design, Bu-Aer, is graduate of Naval Academy. He holds two DFC's, four Air Medals.

R. A. HOLT, Service Engr., Northwest Airlines, joined his company in '42 as mechanic; was in AF during war; rejoined Northwest in '46.

CAPT. G. B. STEERS, Asst. Chief Pilot, Northeast Airlines, joined NEA in 1937; during war, pioneered N. Atlantic routes with NE as carrier.

R. L. STACY, Asst. to Director of Operations—Atlantic, TWA, joined Trans World Airlines in an administrative position after leaving the Navy.

JOHN H. O'NEILL joined Colonial Airlines as copilot in 1945; became Captain in 1946, and today is Director of Flight Operations for Colonial.

T. D. ALLEGRETTI, Chief Inspector, Colonial Airlines, has been with Colonial since he completed study at Boeing School of Aeronautics in '39.

JEROME LEDERER, Director, Flight Safety Foundation, founded that organization to stimulate research pertaining to safety in flight.

D. F. COYNE, General Foreman in charge of Maintenance, Eastern Division, joined the Flying Tiger Line after leaving Northeast Airlines, '50.

J. E. CONNER, Maintenance Mgr., Pacific-Alaska Div., Pan American Airways, joined PAA in 1936; is Aero. Engr. graduate, Carnegie Tech.

WHEATON W. MIES, Chief Inspector, Northeast Airlines, has been with NEA since 1938. During war, was Asst. Supt., Maintenance—Arctic.

CAPT. M. B. CAHILL, Engineering Pilot for Northwest Airlines, has had 18 years airline experience, 16 years as pilot with NWA.; is aero. engr.

T. J. HEALEY, Manager—Schedules for American Airlines, has been with AA since 1929 in all phases of maintenance, overhaul, scheduling, etc.

CAPT. J. O. EISCHEID joined TWA as a pilot in March, 1930. During World War II, he was a Captain with TWA's Intercontinental Division.

R. T. PETERS, Service Engineer for TWA joined Trans World in 1945 after serving as Service Engineer, Hamilton Standard Propeller Div.

AIRCRAFT *that have been in warm hangar should be cooled down before taken out," stated T. J. Healey (left). To Mr. Healey's right are Cmdr. Weatherup of Navy, J. H. O'Neill of Colonial*

T. J. Healey *(Mgr. Schedules & Maintenance, American Airlines):* "As I understand it, there are two types of glycol: ethylene and propylene. One has more effect that the other on cabin plexiglas. What type does Trans-Canada use?"

R. A. Holt: "We use ethylene."

Jerome Lederer: "Is a fire hazard associated with the use of this spray?"

R. A. Holt: "Not to any extent. As I remember, the flash point on ethylene glycol is in the neighborhood of 250°. Of course, it is the policy to keep the spray away from any heater or air scoop, because it will burn."

T. J. Healey: "Is Trans-Canada using the Hudson Sprayer?"

A. E. Ades: *"We are still experimenting with sprayers. Right now we are trying out two different types."*

T. J. Healey: "Your application, Capt. Cahill, is by spray all the way through, not by mop, etc.?"

Capt. Cahill: "We have devised a procedure whereby the man with the sprayer gets up on a lift truck and coats the tail surfaces and aft section. We found that we couldn't adequately cover the tail area on an airplane like the Boeing with just a mop."

A. E. Ades: *"Mr. Conner, let's hear from you on this problem of cold-weather operations."*

James E. Conner *(Maintenance Mgr., Pacific-Alaska Div., Pan American World Airways):* "Our problems in Alaska are slightly different in that we haven't the sleet or ice generation problem so much as we have extreme cold. On the coast at Juno, temperatures generally range from 20° above to freezing in the winter, and we have some icing. We use glycol just as Northwest and Trans-Canada do. On the other side of the mountains, at White Horse and Fairbanks, the problem is just the cold. We rarely have the ice problem. At those two stations, it's the little things you do that make the job easier, as has been pointed out earlier. We, of course, schedule the airplane on the ground a minimum of time."

Thomas D. Allegretti *(Chief Inspector, Colonial Airlines):* "We're confronted with pretty much the same problems as Northwest, especially here at LaGuardia, at Albany and a few other stations, but not to as great an extent at Montreal as far as ice and sleet are concerned. To combat ice and sleet, we use the same methods that have been described by Mr. Holt and Capt. Cahill.

"We had a unique problem at Albany, N. Y., one night when we had three of four airplanes cancel out there. The temperature was such that it was a cold, dry snow. There were no hangars available for storing the aircraft and there weren't enough people to keep the aircraft clear of the snow so that when the weather broke we could get out. However, we did happen to have a foreman aboard who was riding non-revenue at the time. He had us line up the aircraft, one behind the other, and then he got into the first one, a DC-4. He started all four engines and then just sat there for about two hours, all engines going. He kept the other airplanes clear!"

John H. O'Neill *(Dir. Flight Operations, Colonial Airlines):* "Wet snow gives you a lot of trouble at Montreal in the spring and fall, not so much in the wintertime. Montreal isn't too much of a problem because we can always get into a hangar there. In fact, oftentimes during a winter, we operate right out of a hangar. We load and unload in the hangar, and we even get our clearance while we're still in the hangar. Where we do run into winter problems is with the freezing precipitation on local flights where we have a number of landings. On a day when there's any kind of precipitation that's sticking, we can get caught pretty sadly at a station that has no maintenance facilities."

A. E. Ades: *"Passenger handling during wintertime is also of concern. Mr. Steers, would you comment on a method of keeping passengers comfortable on the ground and in the air, too?"*

Capt. George B. Steers *(Asst. Chief Pilot, Northeast Airlines):* "That doesn't present too much of a problem when we can pre-heat the airplane on the ground. We use Herman Nelson heaters to do that. Janitrol heaters keep the cabin comfortably warm in flight."

A. E. Ades: *"Do you operate gasoline-burning heaters in the aircraft on the ground?"*

Capt. Steers: "Yes, with cabin heat blowers in operation."

A. E. Ades: *"May I ask American Airlines how they keep their passengers warm on the ground."*

T. J. Healey: "Speaking only of such high-density stations as LaGuardia, we try to do a good passenger relations job by analyzing in advance what our operating capabilities are going to be. In other words, if weather conditions are such that we can operate only spasmodically, we try to plan our operation ahead of time by cancelling out those schedules that are obviously going to be delayed to such an extent that they are of no value to the passenger. We spread our departures; instead of having one every half hour, we schedule on every hour or every hour and a half. We do that ahead of time so that we can advise the passenger before he gets out to the airport. It isn't good business to hold a passenger at the airport along with 50, 100 or 200 others. The end result is a lot of unhappy passengers fluttering around a waiting room. Instead, we bring the passengers out to the airport by groups and on a pre-planned basis. We load them on the aircraft in the hangar and we dispatch the airplane in the routine manner from the hangar.

"One other point I'd like to emphasize is that when you take a warm airplane out of a hangar and into the outside cold, you're in trouble if it happens to be raining

or snowing. One can't over-emphasize the importance of opening the hangar doors in advance to cool down the hangar and the airplane before taking it out."

T. D. Allegretti: "I made a note here of an idea we tried out last year at Glen Falls. We kept a DC-3 in an unheated hangar, and we set up a battery of six infra-red lights in front of the engines. The use of these lights kept the engines warm enough to permit an early-morning departure without any pre-warm-up, and it eliminated the necessity of a fire guard and a portable heater."

A. E. Ades: "*Most operators have proved that if they can maintain thrust in the air, they don't feel too much concern about flying through an icing condition. The development of ice-protective devices has been a long-term proposition. Mr. Peters, would you give us your opinions regarding electro-thermal and alcohol de-icing systems.*"

Robert T. Peters *(Service Engineer, Trans World Airlines):* "In all of its equipment TWA utilizes only one type of propeller anti-icing system, and that's isopropyl alcohol. It's done very basically—a simple alcohol pump delivers isopropyl alcohol to a nozzle on a swing arrangement out through a feed trough and distributes it along the propeller blade. We've never used the electrically heated system. Due to the type of service the isopropyl alcohol has given us, we see no cause to go to any other system."

Capt. Cahill: "Relative to this propeller situation, our best prop experience to date was with the original propellers on the Boeing which, unfortunately, had other very undesirable characteristics. With the internally heated blade, we had absolutely no adverse operational reports from the crews. However, because of trouble with the internal heating elements, we had to go to externally heated boots, and we had several adverse reports on those, performance-wise. We know we're not getting the same de-icing efficiency as before, because we're getting more reports of vibration due to propeller unbalance with the externally heated boot. We haven't used alcohol de-icing on any modern-type airplane, so I'm not in a position to comment much on that."

Col. Balchen: "We have had an opportunity in the Arctic to use both fluid de-icing and heated element de-icing on different types of aircraft, and we're more satisfied with fluid de-icing. We don't get as much propeller unbalance because of ice sticking on certain elements, and impairing efficiency."

Wheaton W. Mies *(Chief Inspector, Northeast Airlines):* "We have DC-3's which use fluid, and we have electric external boots on our Convair Curtiss propellers. When we started operating the electric external boot, we had a high rate of deterioration of the leading edge of the boot which exposed the wires and caused them to break, thus the boots became inoperative and this resulted in unbalance. Since then, however, we have modified our boots. We have the same boot, but we have installed a metal sheath over the boot which protects it, and we haven't had anymore deterioration. We go through several prop overhauls before we have to replace the rubber boot."

T. J. Healey: "Would any of the operators here care to express an opinion on the use of Icex as an auxiliary de-icing agent?"

W. W. Mies: "When we have propeller boot failure or electrical prop de-icing failure, we use Icex, but thus far it has been only on an emergency basis."

"ELECTRONIC BLACKOUTS *in the Far North completely block out communications over long periods," explained Col. Bernt Balchen (left) Air Force Arctic expert, seated next to J. E. Conner*

A. E. Ades: "*Mr. Conner, have you any comments to make regarding engine protection during cold-weather operations?*"

J. E. Conner: "As far as the engine's protection from an operation standpoint in flight, we have found a few things that have to be done, such as the lagging of some of the external vent lines and drain lines, and an occasional shield over a propeller cable that operates the propeller governor. On the ground in cold weather we use what we call banjos that are put into the cowling around and in front of the engine. By closing off that area we've been able to start our engines after stops of an hour and a half at 40° or 50° below, and without any pre-heat from any external source. In addition to that, we use the engine cover with Herman Nelson heaters. If we can keep the engines warm, we don't have any problems."

Col. Balchen: "The Air Force works along lines similar to those Mr. Conner expressed. We do have to winterize our engines. When you are flying through, as the airlines do, you are not faced with the problems of extremely low temperatures the way you are if you're operating from a base in the Arctic, where temperatures run between 40°, 50° and even 60° below zero. A special technique for warming an engine so you can get it to turn over in the morning has had to be developed for each aircraft. It's a pre-work before preflight. Despite these developed techniques, we still need outside heat on the engine and in my opinion, if you're going to operate from stations in the Arctic, you have to have heated shelters for the aircraft so they can be efficiently operated. Not only do we need heat for all the aircraft but we have to have it for all other vehicles and equipment as well.

"Handling tools properly when you're wearing mittens is a special technique; to avoid getting a frost burn is a special technique. It's a special technique to take care of yourself at a wind-chill factor of 1400; that's what we call a critical limits factor, when we have a wind chill of 1400 calories an hour. At minus 40° in a 2-mph wind, flesh freezes right away. It also freezes right away at zero temperature in a 15- or 20-mph wind; and at 32° in a 50-mph wind. That is *(Continued on Page 45)*

Performance

from the Files of the Flight Safety Foundation

A booklet entitled "*The Common Man—Up in the Air,*" recently was authored for Flight Safety Foundation by Howard G. Kurtz, Jr., a pilot and an industrial engineer, and illustrated by Robert Osborn, SKYWAYS' long time illustrator for "Performance Pitfalls" and, before that, "Dilbert." This booklet is a study of airline passenger reactions and the psychiological factors which underlie those reactions. Because of its interest to all pilots, whether they fly air transports or single or multi-engine business aircraft, we are herein reprinting two excerpts from this booklet. Understanding passenger emotions should help the captain in his duties as in-flight overseer of passenger safety.

Orientation

Some time ago the pilot of a New York to Chicago flight came face to face with the critical role of orientation. The flight had been uneventful although it had been in the clouds all the way, and the passengers had not seen the ground since the take-off at New York. The tenseness among the passengers could be sensed and it continued to mount. Increased muscle tension was noted, and the earlier relaxed conversations among the passengers dwindled and finally became transformed into stony silence.

At that moment the captain did something about it. He took a blank piece of paper, wrote on it, and had the stewardess pass the note back among the passengers. The note stated that the flight had just passed over Detroit; it mentioned the specific time, and gave the altitude at which they were flying, reported the sun was shining at their destination and told them they would be arriving in Chicago in about one hour and 11 minutes. It further reported the outside air temperature at their altitude and the temperature on the ground at Chicago.

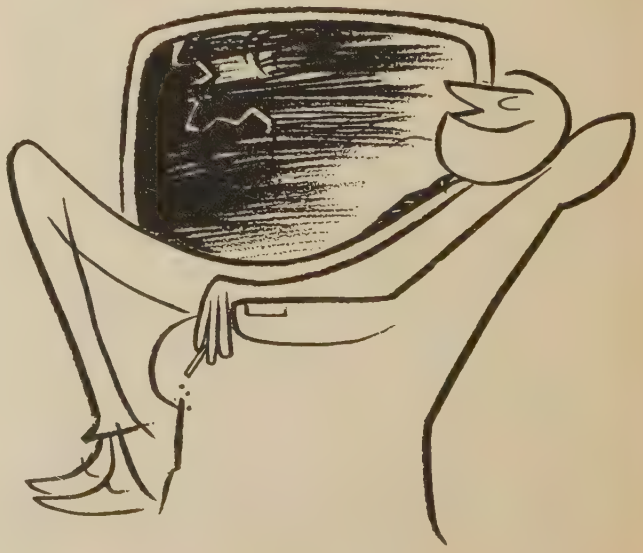
A distinct change was noted in each passenger as he read the note and passed it along. Tension was relieved, informal conversations were resumed, and smiles began to reappear on faces that had been grim and stony.

Ever since that first success with in-flight reports, it has been standard operating procedure on all airlines.

Orientation is a basic need of human beings when they are placed in unusual situations or environments where, to them, there is potential danger. When orientation is lacking under these conditions, anxiety builds up and accumulates.

The fully effective captain or pilot not only provides orientation for his passengers at regular intervals enroute, but he provides prompt orientation to anything unusual which occurs in flight. He knows that a loud noise or backfire can cause anxiety to generate among his passengers, so he provides a prompt explanation of them.

The professional pilot knows that advance warning is the most effective kind of orientation. If a passenger looks out of a window and sees one of the propellers stopped, anxiety wells up in him. On the other hand, an advanced warning from the captain that he is about to feather the prop can result in having the passenger watch the engine stop without any surge of anxiety or fear on his part.



PITFALLS

by Jerome Lederer and Robert Osborn

Captain is a Symbol

When parent-child relationships are healthy, a father emerges as a symbol of relief from anxiety for children. The role of a captain in relation to his passengers is quite parallel. The captain is a symbol, a sort of "father-image," in a situation where the passenger is incapable of controlling his own destiny and anxiety. This symbol-function of the captain is quite unrelated to the captain's outer personality. The symbol-function can be carried out successfully by a captain whether he is tall or short . . . handsome or drab . . . charming or ill-at-ease . . . or whether his voice is modulated or rasping . . . or whether the passengers see him or not.

The captain's confidence must show through all of these. At all times he must give the over-all impression of "I know where I am and what I am doing . . . I know what is up ahead . . . I have things under control. Relax and let me be concerned with the flight. I will keep you posted."

This communication must come through to the passengers in the captain's own way. It makes no difference whether his grammar is flawless or whether he murders the language. There are many channels for this communication from captain to passengers, and any one of them may be used. He may talk over the public address system; he may instruct another crew member to relay his message for him over the PA system; he may write a note to be passed among the passengers; or he may walk through the cabin and deliver the information personally to the passengers.

Whatever method he uses, one fact is certain: the captain is responsible for his passengers safety and that includes their peace of mind. An alert captain or pilot keeps his passengers relaxed and happy for having been aboard his airplane.

Flight Check Errors

Check pilots list the following errors in crosswind landings, as occurring frequently on flight checks:

1. Landing in crab or skid, without correcting for drift; drifting over the runway.
2. Poor alignment with runway on approach; over-correcting or generally poor drift correction.
3. Approaching too fast.
4. Not holding heading on landing roll.

The following frequent errors were caught during check flights on ILS approaches:

1. Over-correcting, under-correcting or generally poor bracketing on localizer from inner marker to the field.
2. Poor control of airspeed from outer marker to field.
3. Varying rate of descent or altitude on approach.
4. Poor application of power to stay on glide path.
5. Making large corrections in heading immediately after procedure turn.
6. Poor control of altitude at markers; staying above or below glide path.

The errors that occurred in flight checks on intercepting a predetermined track and tracking away from station in climb, included:

1. Over-correcting, under-correcting, or correcting in opposite direction while bracketing or compensating for drift.
2. Poor control of airspeed going into, coming out of, or in the turns.
3. Varying rate of climb in turns.
4. Confusing direction to turn or heading to take to approach track.

These are the errors in three different categories that "the other fellow" makes. How does the check pilot rate you in these procedures?

SKYWAYS FOR BUSINESS

NEWS NOTES FOR PILOTS, PLANE OWNERS OPERATING AIRCRAFT IN THE INTEREST OF BUSINESS

RILEY TWIN NAVION *conversion is now powered by 150-hp engines instead of the 140-hp engines that powered earlier models. This particular Twin Navion recently was delivered to Jack D. Barrett, owner of a network of Piggly Wiggly stores in Texas and Oklahoma*

De Havilland Has New Dove and New Heron Available in the U. S.

Hatfield, Eng. De Havilland Aircraft, builders of the twin-engine *Dove* and the four-engine *Heron*, have readied new models of these aircraft particularly suited to business-flying purposes. The new *Dove* already is in the United States; and the new version of the *Heron* is expected to arrive soon for demonstration to American businessmen.

The latest model *Dove* is fitted with new Gipsy Queen 70 MK 2 engines, each developing 380 hp, some 40-hp more per engine than that powering the earlier *Doves*. Installation of the Gipsy Queen 70 MK 2 engines required no modification of the existing engine mount structure, pipe lines or controls, and the increase in engine weight is negligible. Gross weight of the new *Dove* 6 executive model is 8800 lbs; take-off to 50 ft. at s.l. is 810 yards; rate of climb at s.l. on one engine using maximum power is 135 fpm; landing distance over 50-ft. obstacle is 650 yards. Economical cruising at 8,000 ft. is 180 mph. Operating costs, calculated by the British SBAC method, for a stage length of 400 miles and assuming an annual utilization of 1500 hours is approximately 32 cents per ton-mile of payload. This represents a 10% improvement over the direct operating costs of the earlier *Doves*.

The new *Heron*, designated *Heron* 2, is fitted wih a retractable landing gear and is powered by four Gipsy Queen 30 MK 2 unsupercharged direct-drive engines of 250 hp each. As an executive airplane, the *Heron* 2 seats eight passengers. It has a gross weight of 13,000 lbs. Employing 20° flaps, the *Heron* 2 will clear a 50-ft. obstacle on take-off in 750 yards. It has an initial rate of climb of 930 fpm; with flaps up, the *Heron* has a 1140-fpm rate of climb. Service ceiling is 18,000 ft., and with a typical cruising weight of 12,500 lbs, on 65% METO power, the TAS of the *Heron* 2 is 183 mph.

Main difference between the *Heron* 1 and *Heron* 2 is the retractable landing gear.

Both the new *Dove*, which already is in business use in the U.S., and the new *Heron* are expected to be popular as business aircraft.

Airwork Announces New Power Now Available for the DC-3

Millville, N.J. Airwork Corp., East Coast distributor for Pratt & Whitney Aircraft, has announced that they can deliver R-2000-7M2 engines for DC-3 installation within 45 days of receipt of a confirmed purchase order. These R-2000 engines are converted by the installation of Pratt & Whitney Conversion Kit #323, which includes 141 factory-new parts such as new crankcase, new crankshaft, new muffed barrel cylinders, pistons, cams and associated parts. Price of an engine FOB Millville, N.J. is $22,000 for an outright sale, and includes carburetor, ignition harness and magnetos. An exchange credit will be allowed for an operator's present engines.

For those operators requiring two-speed impellers, the R-2000-11M3 engine is available at $22,500.

Listed advantages of this R-2000 conversion for the DC-3 include:

1. Engine is currently proven in schedule airline service in DC-4 aircraft.
2. P&W current-manufacture new parts are available to support the engine for the future.
3. Overhaul and exchange service is available from Airwork Corp.
4. There is from 100 to 250 additional horsepower available over the R-1830 series engines. This added horsepower results in increased speed, performance and load-carrying ability.

Arrangements presently are being made with leading airframe modification centers for CAA approved installation of these engines in accordance with part 4A and 4B of CAR's.

NDTA Signs Aid Agreement with National Red Cross

New York. The resources of the National Defense Transportation Association have been placed at the disposal of the American National Red Cross for use in disaster relief emergencies, it was recently announced by E. Roland Harriman, Red Cross board chairman.

In making the announcement, Mr. Harriman declared, "This will mean that in

PIPER TRI-PACER *for 1954 recently was unveiled at Lock Haven, Pa. The four-place Tri-Pacer is powered by 135-hp Lycoming engine, has 132-mph cruising speed at 7,000 ft. at 75% power. It has 100-lb. baggage capacity, and a useful load of 910 lbs.*

ime of disaster, experts in all fields of ransportation will be ready to go into ction as Red Cross volunteers, and hrough their experience and knowledge f the resources of their fields, they will e in a position to mobilize transportation o bring needed supplies and manpower nto a given area." This includes NBAA-ember aircraft.

The NDTA assistance may include:

a. Mobilization for immediate assignment of necessary transportation facilities of land, water or air, for purpose of survey or movement of people and their property.

b. Transportation of supplies from depots, warehouses or stores to relief centers.

c. Transportation of doctors, nurses and relief workers.

d. Transportation, when necessary, of supplies borrowed from the military . . . cots, blankets, etc., from military depots to the area of disaster.

Members of the National Defense Transportation Association present when the agreement was signed by E. G. Plowman, vice president of U.S. Steel and president of NDTA, and Mr. Harriman, included Jean H. DuBuque, Executive Director of National Business Aircraft Association.

News Notes of Interest Re. Aero Material and Medicine

New York, N.Y. Van Dusen Aircraft Supplies has opened an aviation parts center to serve the Washington, D.C. area. Located at Beacon Field in Alexandria, 20 minutes from downtown Washington, the new Van Dusen outlet includes office, store and warehouse facilities to maintain a stock of aviation parts, supplies, etc.

Millville, N.J. Airwork Corp. has been appointed an official service station for Leece Neville Co., manufacturers of M-3, L-3, L-2, and 0-1 generators used on P&W R-985 through R-1830 engines. Spare parts for these generators and exchange units, as well as overhaul is available at Airwork.

Piqua, Ohio. Although Hartzell isn't doing much talking about it right now, the company will add a three-blade, full-feathering propeller to its line early this year (1954). One of the first installations probably will be on the Aero *Commander*, now equipped with Hartzell's two-blade, constant-speed propellers.

New York, N.Y. A new drug which in large scale tests proved to give 24-hour protection agains motion sickness has been made available. Called "Bonamine," the new drug was tested by the U.S. Army, Navy and Air Force doctors and was compared with other motion-sickness drugs now available. These doctors reported that "Bonamine" was the only drug which gave a marked protection against seasickness and airsickness when given only once a day. The drug is *not* for flight crews; it is just for passengers. It is being used on board Sabena air transports for those passengers who have a tendency toward motion sickness.

....in the Business Hangar

Lloyd Santmeyer, chief pilot for Allegheny Ludlum Steel Corp., and his copilot, Barney Harrington, flew the company Lockheed *Lodestar* to Lockheed Aircraft Service, Burbank, for tank work and relicensing.

AiResearch Aviation Service has completed initial installation of its geared rudder and aileron trim tab modification on the executive DC-3 owned by The Garret Corporation. This DC-3 is the first one to receive complete modification including larger engines, new cowl flaps, geared rudder trim tab and geared aileron trim tab.

Sears & Roebuck (Los Angeles) DC-3 is back in operation after installation of Collins punch card navigation computer. This equipment, as well as the Integrated Flight System, dual 51R-3 navigation receivers, 51V glide path receiver, and 17L-3 transmitter, was installed by Qualitron. Bob Waggoner and Paul Carabelli are Sears' pilots at Los Angeles; J. V. Swanson is Chief Pilot and NBAA representative.

Dick Henderson, pilot of Johnston Testers' Twin Beech, has the plane at Horton and Horton Upholsterers, Houston, Texas, for a new interior.

Page Airways, Rochester, N.Y., recently completed installation of Collins 51R-3 VHF receivers and 17L-3 transmitters in the *Lodestars* belonging to Dienst Construction Company and the Youngstown Sheet and Tube Company.

Chief Pilot A. K. Roden and his copilot, L. R. Moe, flew Bechtel Corporation's *Lodestar* to Lockheed Aircraft Service for annual relicensing.

Columbia-Geneva Steel recently put into operation their newly purchased *Lodestar*, and resumed operation of their PV-1 after installation in each airplane of a Collins 17L-3 transmitter and 51R-3 receiver. Roy Rollo is Columbia-Geneva's chief pilot and NBAA representative.

While Lynn Carney, pilot for George W. Strake of Houston, was at the NBAA Convention in St. Louis, he picked up a new Deluxe Super-92 C-47 from Remmert-Werner. In addition to Super-92 engines, the airplane features complete Collins radio, three extra large picture windows.

L. M. Keating assistant to the president of A. O. Smith Corporation, brought his *Navion* to Horton and Horton for new interior upholstery.

Tom Teate, pilot for Borg-Warner, took delivery recently of a new Deluxe *Lodestar* from Remmert-Werner. The *Lodestar* is powered by R1820-56 engines and features Collins radio.

Steve Brown, chief pilot of Continental Can Co., recently flew back to home base at Morristown, N. J. with his company's newly converted Martin B-26. Leonard Lee, Continental's superintendent of maintenance, made the trip with Mr. Brown. Conversion was done by AiResearch Aircraft Service.

Minnesota Mining and Manufacturing Company has its second DC-3 at Remmert-Werner for installation of a Sperry A-12 autopilot. Mel Longlet, in charge of aircraft scheduling for M&M, and Armond Hinkle, M&M's pilot, brought the DC-3 to Remmert-Werner from St. Paul. Don Richardson is M&M's NBAA representative.

Another NBAA member, Owens-Illinois Glass Company, has had its DC-3 at Remmert-Werner for 1,000-hour inspection, relicense and installation of an automatic heat control. Dick Riggs is company pilot and T. A. Kaatz is NBAA representative.

Mesta Machine's A-26 is back flying the skyways after Qualitron installed dual Collins 51R-3 navigation receivers, dual 17M-1 50-watt transmitters, a 51R-3 communications receiver and dual 51V-1 glide slope receivers.

Engineers mount cameras and X-wing on supersonic rocket to test new design.

On California desert, rocket begins flight reaching 3 times the speed of sound.

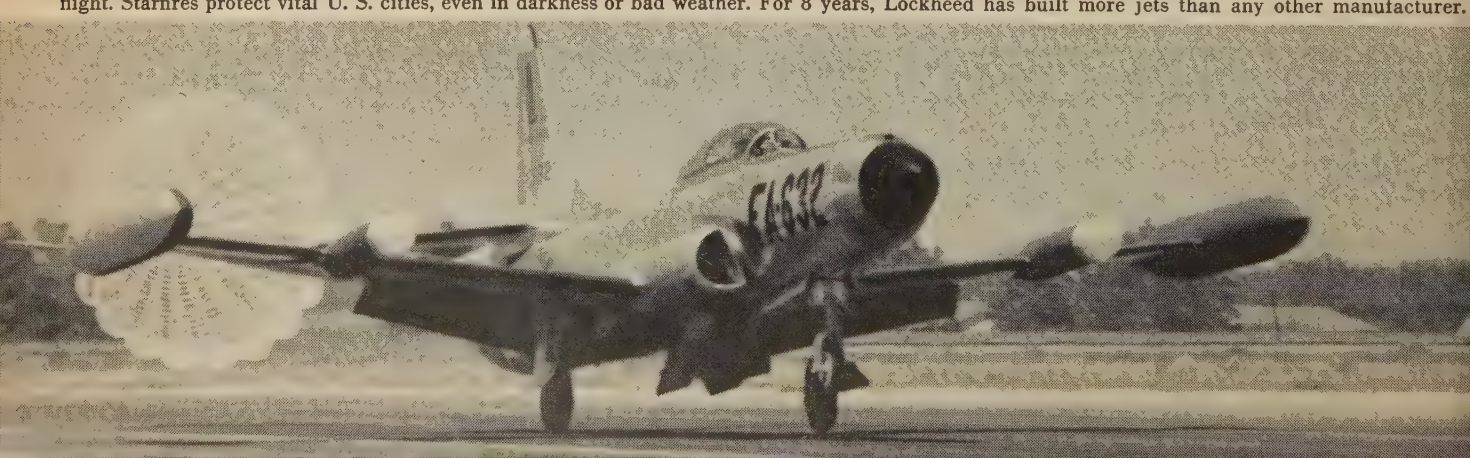
Desert craters fade away as camera records speed effect on new experimental wing.

Here, another wing desig flaps violently from the pre sure of the supersonic spee

Lockheed Scientists Shape the Forms of

Lockheed's Expanding Science Center Improves Today's Planes and Develops New Designs fo

FIRST IN THE NATION'S ALL-WEATHER DEFENSE. Lockheed F-94 Starfires are jet interceptors loaded with electronics for almost automatic flight. Starfires protect vital U. S. cities, even in darkness or bad weather. For 8 years, Lockheed has built more jets than any other manufacturer.



Parachuted to earth, rocket camera is recovered with film data vital for the future.

iture Flight

Era of Automatic Flight

ove film strips take you behind the to show Lockheed scientists test- w wing designs for future aircraft times faster than today's. This is mple of advanced research at Lock- expanding Science Center. Scien- gineers work with nuclear energy, ss aircraft, electronics systems, new for the era of automatic flight.

kheed discoveries in *pure* science atched by Lockheed progress in d science. Lockheed's science of de- as produced a radar-laden team of ting military aircraft—flying radar s, almost automatic interceptors, bmarine patrol bombers. Skill in e of production enables Lockheed to e 12 different models simultane- —and all models are on schedule!

SCIENCE CENTER — *Future forms of flight are studied here in Lockheed's new Engineering and Science Building.*

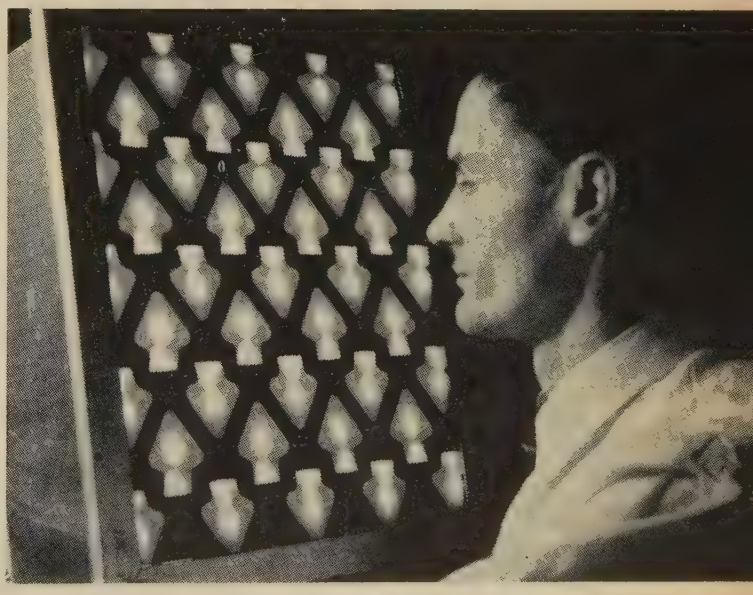
Announcement

Important news in the U.S. aircraft industry this month was establishment by Lockheed of a new Missile Systems Division, a separate organization integrating 10 years of research and development in the field of electronics and pilotless aircraft. Important progress in current top-secret work at Lockheed prompted decision to establish new division in expanding field of automatic flight.

FIRST! FLYING RADAR STATION. Lockheed Super Constellations, with radar humps, provide Navy and U.S.A.F. with new concept of defense —a new method of detecting an enemy hours in advance through applied electronics.

FIRST! ELECTRONIC SUB PATROL—Advanced models of Lockheed P2V Neptune Bombers give U.S. Navy long-range sub patrol with destructive power and advanced sonic devices.

TOMORROW'S METALS. Planes 10 to 25 years from now, currently under study by Lockheed, will require new materials to withstand tri-sonic speeds. Here, Lockheed scientist checks X-ray film of new metal.



COMING SOON—*Look for other dramatic new Lockheed models soon, including XF-104 Day Superiority Fighter.*

Lockheed

Lockheed Aircraft Corporation, Burbank, California, and Marietta, Georgia

LOOK TO LOCKHEED FOR LEADERSHIP

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1029 Vermont Ave., N. W. Washington 5, D.C. Phone: National 8-0804.

NBAA Organizes Aircraft Design-Development Com.

A standing committee is being organized by the National Business Aircraft Association to work closely with airframe and engine manufacturers on the design, development and financing of aircraft tailored to meet the special requirements of the rapidly expanding business aircraft market.

The decision to form such a working group was one of the major developments at the NBAA's sixth annual meeting, part of which was devoted to a design panel forum attended by representatives of the principal aircraft and engine companies. Members of the new committee will establish continuous liaison with manufacturers, assemble design criteria which can be used by engineers as basic specifications, and constantly compile market information useful to aircraft sales staffs.

Announcement that NBAA would appoint a design group to cooperate with the industry came soon after the annual convention design panel participants had discussed many of the problems involved in the task of obtaining new, special-type aircraft for business and industrial users.

It was the consensus of manufacturers' representatives, who were on the receiving end of a barrage of questions during the St. Louis session, that the first obstacle to be overcome is a big one—finance. However, exploration of that problem opened the following possible solutions:

1—Market research data which would provide virtual assurance that a minimum of 300 aircraft of any one type could be sold within a five to seven-year period following acceptance of a basic design.

2—Military participation in the development and use of an airplane acceptable to all concerned.

3—The posting of bonds by potential users of a new design as a means of helping to underwrite development costs.

Any one of these proposals would, if adopted, serve as a guarantee to the manufacturers that his aircraft would find a market. The market was defined by the manufacturers as not less than 300 aircraft.

Manufaturers believe they can design and build any type of airplane needed by the executive market. Price is the big problem. In other words, how much airplane can executive users get at the price they can afford to pay and how many will be able to afford it? And will the airplane they get at that price provide the desired performance? The NBAA committee hopes to find answers to these questions.

Cole Morrow, chairman of NBAA, served as moderator of the forum and the following manufacturers' representatives took part: Herb Rawdon, Beech; Edward Williams, North American Aviation; Arthur Cruise, Lear, Inc.; George Page, Aeronca; and J. Gerteis, Cessna.

NBAA has high hopes that, through the work of its new design committee, it will move much closer in 1954 toward realization of a basic goal.

Wright Aeronautical Corporation, confident that the expanding business aircraft market will provide a large market for piston engines for many years to come, is maintaining close liaison with NBAA members concerned with new business aircraft designs. Wright believes that the combination of its R-1820 engines and clean aerodynamic design can provide the business market with aircraft cruising at 300 mph or better. The Wright HE engine, rated at 1525 hp for take-off, has attained the low weight to power ratio of .93 lbs. The 1820 series powerplant is being considered for installation in the projected twin-engine executive airplane in the planning stage of development by Aeronca.

NBAA Recommends Standardization in Accounting Methods

Another significant event during the convention was presentation of NBAA's recommendation for standardization in accounting procedures to aid in the exchange of statistical information on aircraft operations. As chairman of the accounting standards committee, Henry W. Boggess of Sinclair Refining Co., suggested that ground expenses should encompass hangar charges, landing fees, the correct ratio of ground crew salaries, licensing costs and taxes, and maintenance and repair charges. Against flight expenses, he said, should be charged insurance, meals aloft or on the ground, salaries of crews and their expenses away from home, uniforms, and literature and charts essential to the job.

Boggess reported that any listing of costs of depreciation should include the rate of depreciation, and that statistical reports should record miles flown, hours in the air and costs per mile and per hour. The committee recommended the elimination of revenue-mile and passenger-mile data as non-essential in business aircraft flying.

Forum Highlights Problems in Air Traffic Control

The annual members' forum, with Ralph E. Piper, chairman of the technical committee and chief pilot for Monsanto Chemical, as chairman, produced discussion on the following subjects: CAA ATC tower operations, VOR and L/MF ranges, high density air traffic control, radio frequency difficulties arising from heavy usage. Questions based on NBAA problems in these fields were directed at representatives of CAA, U.S. Weather Bureau, and the Office of the Undersecretary of Commerce for Transportation.

Mr. Piper told the group that NBAA regional sessions with CAA traffic controllers and tower operators and with weather bureau personnel have brought about more efficient handling of business aircraft without interfering with airlines operation or other aviation activity. He also reported that the Department of Commerce now has under consideration numerous NBAA recommendations for improving weather forecasting and reporting.

Herbert O. Fisher, chief of aviation development for the Port of New York Authority, reviewed the problem of aircraft noise in such density areas as New York and measures being taken to alleviate it. He pointed out that noise is principally a responsibility of scheduled airlines, but that private, executive and military operators can contribute to its abatement. He urged every NBAA pilot to study and follow noise abatement and safety procedures when flying into high density areas. He warned that failure to do so could involve executive pilots as co-defendants in anti-noise suits filed by individuals and communities.

CAA Announces Establishment of VOR Accuracy Checkpoints

Fred B. Lee, CAA Administrator and the principal speaker at the annual dinner, disclosed that CAA is establishing facilities and check points to enable NBAA pilots to determine the continuing accuracy of VOR sets. Air carriers are making their check facilities available without cost, he said.

Other speakers during the convention included Theodore Hardeen, Jr., DATA administrator; Col. William S. Lawrence, FCDA transportation director; E. R. McCarthy, aeronautical charts chief of Coast and Geodetic Survey; Harland S. Herrin, NATA president; and Jerome Lederer, director of Flight Safety Foundation. O. K. Armstrong, former Congressman from Missouri, served as toastmaster of the annual luncheon and Jennings Randolph, assistant to the president of Capital Airlines, was toastmaster for the annual dinner.

NBAA By-Laws Revised and Officers Elected

Three amendments to the NBAA by-laws were adopted by unanimous vote, the most important being a revision in Associate member requirements. The new amendment, subject to final approval by the board of directors, permits NBAA to accept as an Associate member "any corporation, company, partnership, institution or individual primarily in aviation or air transportation." Such members need not own or operate business aircraft to qualify.

Cole H. Morrow, chairman of the NBAA board, summarized activities during the preceeding year, placing emphasis on the several concrete accomplishments for business flying. He pointed out that NBAA has grown in stature and that it had received long over-due recognition at the national level.

Cole Morrow was re-elected chairman of NBAA for a third term and Henry W. Boggess was named vice chairman, a new office. Stetler B. Young of Rynel Corporation in Sterling, Ill., was elected to the board. Directors re-elected were: William B. Belden, Republic Steel Corp., Cleveland, O.; Joseph B. Burns, Fuller Brush Co., Hartford, Conn.; Delos W. Rentzel, Auto Transports, Inc., Oklahoma City, Oka.; Mr. Morrow and Mr. Boggess.

Highlight of the annual luncheon was the presentation of "pilot proficiency" awards to 42 NBAA first pilots *(SKYWAYS*, December) for flying 500 thousand or more accident-free miles on business.

The annual dinner was marked by announcement of a special award honoring Charles E. Lindbergh for his 1927 New York to Paris flight and for his "many contributions of immeasurable and enduring value to aviation and the defense of the nation."

CAB Delegates Small-Plane Accident Investigation Authority to CAA

The Civil Aeronautics Board has announced that it has taken action to delegate to the Administrator of Civil Aeronautics, authority to investigate small-plane accidents. The action becomes effective with respect to accidents occurring on and after January 1, 1954. Under this delegation, the Administrator will have full responsibility for the investigation of accidents involving civil aircraft of less than 12,500 lbs maximum take-off weight, including the release of any reports thereon which he may determine to be in the public interest. As heretofore, the Board will continue to investigate accidents involving all aircraft of more than 12,500 lbs, accidents involving helicopters irrespective of weight, and accidents relating to small aircraft operated by air carriers in Alaska holding certificates of public conveyance and necessity.

The Administrator will not hold public hearings of any of the accidents he investigates. If such a hearing is considered desirable by the Board, the Administrator or any interested person, the Board may notify the Administrator that with respect to that accident the delegation is rescinded. Thereafter, the accident will be investigated by the Board, including the holding of a public hearing, if the Board deems such action desirable.

The Board pointed out that it will be necessary to amend the accident reporting requirements under Part 62 of the Civil Air Regulations to reflect this delegation, and that work on such amendment is now proceeding. However, present reporting requirements should be followed until they have been formally amended.

This action is the result of a study conducted by the Board to determine areas where duplicating and overlapping functions performed by the Government might be eliminated. The Administrator already conducts investigations into accidents of this nature to determine whether violations of the Civil Air Regulations have occurred; and the investigation of accidents of this class, which are generally routine in nature, can be combined with the Administrator's investigation already taking place.

CAA CERTIFICATE *honoring Russell F. Holderman (left), chief pilot of Gannett Newspapers, for his 40 years as a plane pilot, was presented by CAA's F. B. Lee*

Converson of Transmitters from 3105 kc to 3023.5 kc Necessary Before March 15

Business pilots are reminded that the receiving watch on 3105 kc will be permanently discontinued on March 15, 1954, at all CAA communications stations and control towers. The frequency 3023.5 kc which has been guarded at all CAA stations and towers since March 15, 1953, will be used in lieu of 3105 kc after March 15, 1954. Pilots should, therefore, arrange for conversion of their aircraft transmitters from 3105 kc to 3023.5 kc *before* March 15, 1954.

The replacement frequency for 3105 kc (3023.5 kc) has been provided with a guard band on either side to afford world-wide protection which 3105 kc never enjoyed. However, special protective measures have been found to be necessary in certain unusual cases where transmitters are operating on adjacent frequencies at the same location, in some instances in the same building. Until interfering local transmitters or 3023.5 kc receivers or both can be physically separated, it is necessary to reduce the pass band of such receivers effectively to reject all signals not within the frequency stability tolerances specified in appropriate regulations. It is, therefore, more important than ever that airborne transmitters be adjusted to operate within specified tolerances.

Criteria Established for Decommissioning L/MF Ranges

The Air Traffic Control and Navigation Panel of the Air Coordinating Committee has recently adopted certain criteria for effecting a planned decommissioning program for low frequency navigational aids and we have been instructed to proceed accordingly. These criteria establish the following controlling factors which should be met prior to recommending decommissioning of such facilities.

1. The route served by the range must be designated as, or associated with, a VOR "Victor" Airway.

2. VHF instrument approach procedures must be approved or in effect as necessary for the route.

3. The traffic handling capacity of the VHF navigation aid enroute and in terminal areas must be equal to or better than that of the L/MF aids to be decommissioned, and is considered adequate to meet expected air traffic control needs.

Note: In regard to factor #3, recommendations on decommissioning of LF aids are based on the premise that *all* aircraft operating on IFR flight plans in terminal areas or on routes from which LF aids are proposed for decommissioning, will be adequately equipped to utilize available VHF radio aids.

The plan involves retaining 271 L/MF ranges until about 1958, after which time 88 General Service Ranges (full power 400-watt) will be retained indefinitely.

All facilities, including beacons, recommended for decommissioning will be offered to state, local and private agencies which might be interested in operating them (or reimbursing Civil Aeronautics Administration for their operation).

Improved Antenna Systems Being Installed at ILS Locations

Greater safety is in prospect this winter at 62 instrument landing system locations through the use of "null reference" antenna systems in transmitting glide slope signals, according to the CAA.

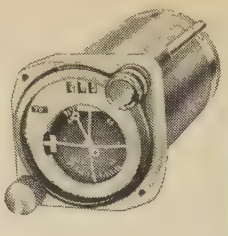
Developed by the CAA Technical and Evaluation Center at Indianapolis several years ago, the "null reference" antenna has the advantage of being virtually unaffected by snow. Normally, changing the level of the ground causes a bend of approximately 1° in the glide path of ILS.

With the "null reference" antenna, however, a snowfall of two feet will result in a change of but one-tenth of a degree in glide path. In addition, the improved antenna system gives the pilot a more positive indication when he is below the glide path as well as providing a glide slope of uniform thickness from top to bottom, regardless of terrain.

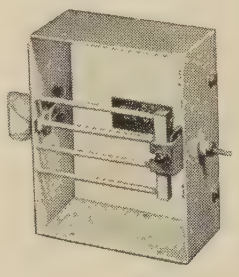
The improved antenna is being installed as existing Instrument Landing Systems are modernized and at locations where the ILS is being installed for the first time. Modernization of existing equipment includes installation of a new type of transmitter and standby equipment.

Instrument Landing Systems operating with glide slope now number 125 with 174 placed in the over-all program.

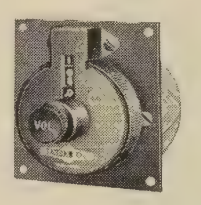
MN-97B—The Bendix Omni-Mag gives immediate visual indication of glide slope information, as well as VOR, localizer, and magnetic heading information.

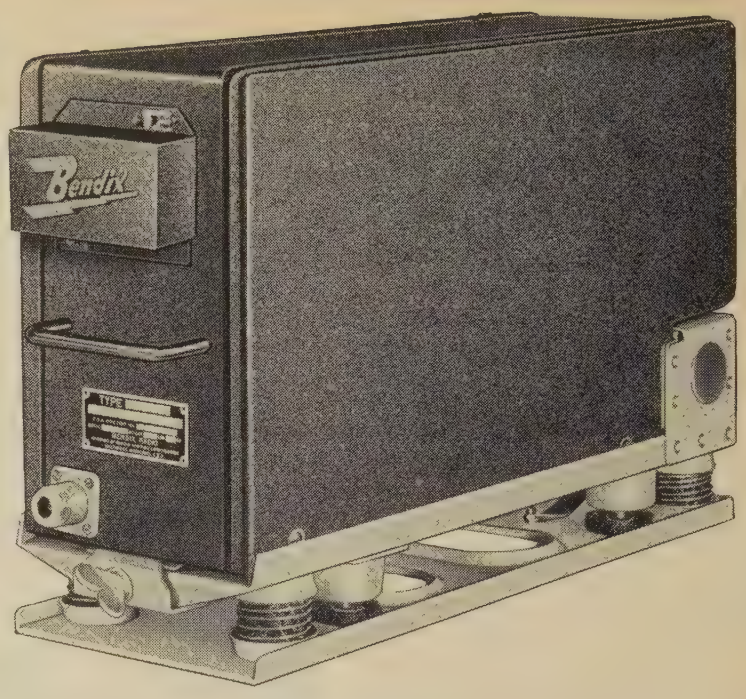


MN-92A—This is the glide slope antenna. It can be mounted flush with the skin of the aircraft. Eliminates drag. Deterioration due to weathering, a common deficiency of external antennas, completely eliminated.



MN-81 — Concentric knob-type channel selector. Calibrated directly in frequency. The same selector used for VOR equipment controls the Glide Slope Receiver.





MN-100A—The Bendix Glide Slope Receiver can be located in any convenient place in the aircraft. Requires no adjustment in flight other than channel selection by the pilot.

New Bendix Glide Slope System

FOR COMMERCIAL AND EXECUTIVE AIRCRAFT

The Bendix Glide Slope Receiver system features a 20-channel receiver (the MN-100A). This is integrated with the Bendix Omni-mag. (MN-97B) . . . with the flush mounted antenna (the MN-92A) and with the famous Bendix Da-Nite channel selector (MN-81).

Excellent Stability

Resonant frequency stability insures reliable, stable signals under all kinds of operating conditions.

The system's high degree of "on course" stability and "course width" stability is characteristic of this fine Receiver.

High Sensitivity

Another one of the system's advantages is its high sensitivity . . . substantially more sensitive than other receivers.

It's so reliable too. Day in and day out its course indications are true under varying changes of temperatures, voltage and signal field strength.

Weighing less than 13 pounds, the Receiver is mounted in ½ ATR housing.

For more information, write to Bendix* Radio at the address below.

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BALTIMORE 4, MARYLAND
A DIVISION OF BENDIX AVIATION CORPORATION
Southwest Sales:
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West Coast Sales
10500 Magnolia Blvd. N. Hollywood, Calif.
Export Sales: Bendix International Division
205 E. 42nd St., New York 17, N.Y., U.S.A.

THE NAME Bendix AVIATION CORPORATION MILLIONS TRUST

Bendix THE MOST TRUSTED NAME IN **Radio**

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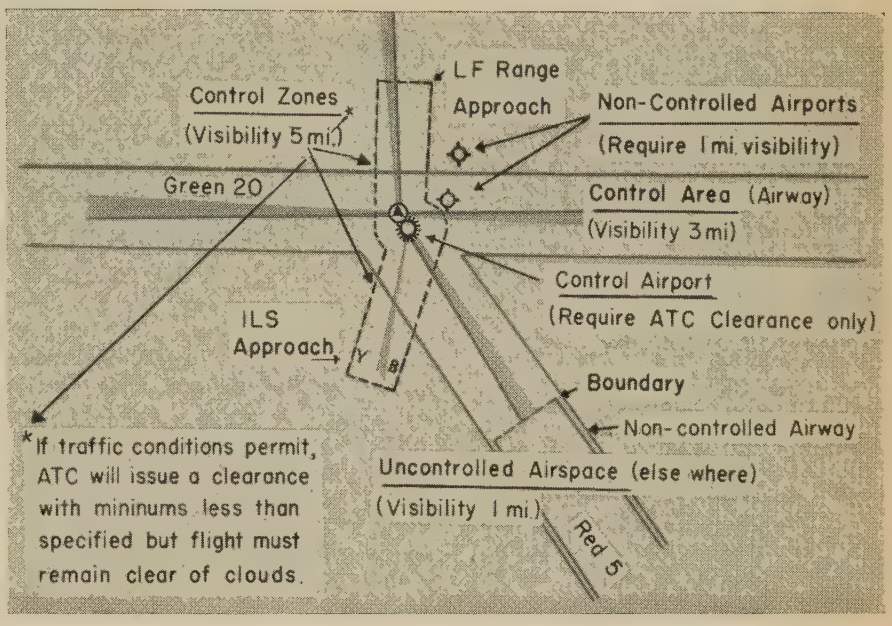
Pilot Cooperation Necessary To Safe Operation in VFR



Because the problems of air navigation and communications are accentuated by the occurance of instrument flight rule conditions, *Navicom* has emphasized the IFR phase of airways operations more than VFR. In the past (and the federal agencies concerned have sponsored this attitude), radio navigation facilities and the equipment to use them have been treated as though their use for VFR flight was purely coincidental.

Even before the improvement brought by post-war developments and their use by civil aircraft, the employment of such flight aids in VFR conditions, like Topsy, just growed! Professional non-airline pilots, like their airline counterparts, have found that experience dictates the wisdom of conducting even CAVU flights in a manner similar to IFR.

When marginal (in between or variable VFR to IFR) conditions exist, the value of this practice has been demonstrated to pilots and to airways controlling personnel alike. Therefore, if *Navicom* is to remain true to its responsibility of service to the pilot of professional standard, whether working at it or not, the controversy of VFR standards must no longer be avoided.

Inasmuch as the original interest in increasing the standards of VFR from three to five miles visibility started with the increase in speed performance of the post-war and less maneuverable airline aircraft, it should be proper to examine this aspect first.

With the increase in traffic and potential collision hazard in terminal areas, it is no longer sufficient to rely on an occasional scan of the horizon from the cockpit. Cockpit duties on approach and climb-out, even when observing all edicts against paperwork, still threaten to break down the disciplined vigilance of the most watchful crew. Multiple frequency requirements, aircraft trim and power-setting changes plus radio navigational movements in marginal visibility pose a serious temptation to get "heads down and locked" during this critical time.

Add to this the tremendous increase in rate-of-closure speed between aircraft, and the theoretical three-mile point of visual perception of another aircraft can dwindle to a time element of seconds in which to recognize a collision course and do something about it.

It is natural that professional pilots, who have qualified themselves and who have equipment suitable for efficient operation on instruments, express a willingness and an enthusiasm for increasing VFR standards in congested terminal areas. The penalties to their operation involve only a slight inconvenience—possibly a short delay, and never the threat of virtual cancellation.

Surprisingly, many airline pilots are antagonistic to such a change in VFR standards and hope for a solution elsewhere. Some even voice the plaintive complaint that if *the other fellow* would only look where he is going or stay on the ground, no change would be necessary. They seem to ignore the inconsistency of accepting the present distinction between VFR limits of one-mile visibility off airways and three-mile visibility on airways (control area), when protesting the proposal for five miles in control zones (still subject to the easement of visibility restrictions to less than IFR minimums when traffic conditions permit!).

Airways personnel in control towers, who have to share the responsibility of separating aircraft under their control, seem uniformly appalled at the potential risk inherent in having numerous aircraft operating under such conditions in omni-directional crossing paths in a limited airspace. So many pilots seem to be throwing "pilot responsibility in VFR" out the window once they establish contact with the tower, that towermen lately have been accusing the pilots of trying to "unload the bag" for the eventual collision while maintaining schedule as their sole responsibility.

Statistically, most recorded collisions have occurred in virtually CAVU conditions, but most near-collisions have occurred in marginal conditions and it is the inevitability of the latter that is worrying the pilots of the larger aircraft. Their solution is simple: keep the other fellow out of their way when the visibility is less than five miles. Granted this boon, some will then put their head back down into the clamps and let the towermen do the thinking and the separating.

Fortunately, the majority are seriously worried about the very real factors of collision hazard and are cooperating with all other interested parties in trying to find a solution which will not be based on eliminating or unduly penalizing any class of

(Continued on page 32)

Pilot Cooperation Necessary To Safe Operation in UFR

(Continued from page 31)

operation.

On the other side of the fence are the self-proclaimed champions of the common man flyer who continually seek to perpetuate their position by loud drum-beating against any move to solve the situation by changing the *status quo*. Emboldened by the coincidence of having been on the right side of a few struggles against the attempts of bureaucracy to impose undemocratic edicts on the flying public, they operate on the magic formulae that any proposal by public agency or other interested parties is *per se* a conspiracy to seize the airways away from the people.

The fact escapes them that the current effort to resolve the collision hazard in marginal visibility is grass-roots inspired at local levels by persons who have no axe to grind and would welcome any serious suggestion that does not just ignore the facts.

To quote the statistics above serves only to prove the point that too many pilots, including airline pilots, do fly around with their heads "down and locked" in CAVU. Most collisions have occurred in areas not considered high-density areas, accentuating the personal-negligence angle. No law is going to make a careless pilot look.

The great worry is that a more catastrophic collision is going to occur in a high density area due to the seemingly unsolvable problem of mixing controlled and uncontrolled high-speed aircraft in great numbers in low visibility. It is a sad fact that previous attempts to solve this problem have been offered by theorists who have tried to assign the airspace arbitrarily to the air-carriers without regard to the basic fact that it belongs to all the flying public.

The little fellow is just as scared of running into a four-engined Goliath as anybody else, but previously he has received little consideration by the deliberating minds, nor has he been represented by anyone competent and anxious to help find a solution that provides for him as well.

Rarely does this little fellow have any reliable means in the air of determining the borderline condition between VFR and IFR. It is either hazy or clear and nobody suggests to him a manner of operating which will minimize the hazard, except to tell him to stay on the ground and out of the air which belongs as much to him as to the big fellow, regardless of the weather.

Safety demands that all aircraft enroute to a pre-determined destination in an area of low visibility meet certain requirements that will enable each to be separated from other aircraft enroute to or departing from the common destination. Prior to the days of heavy-density operation, the so-called "control VFR" approach and departure fitted the bill nicely. It still can in moments when congestion is temporarily lessened.

It is a physical impossibility for today's aircraft of high approach speeds to engage in the gone-but-not-lamented "dogfight" type of traffic pattern around a terminal airport in any kind of low visibility. It has become necessary to establish a system of assigning sequence to these aircraft and lining them up, occasionally from more than one direction, to feed into the immediate landing pattern in an orderly and safe manner. To try and integrate a number of suddenly appearing aircraft of varying speeds into this pattern at a late moment and close-in is not only impractical but highly dangerous.

Hence, serious thought is being given to the idea of requiring all aircraft desiring to land at such a terminal to obtain an ATC (air traffic clearance) while still some distance out of the area. By adjusting path and rate of approach to the area, these aircraft may receive virtually a straight-in arrival instead of being compelled to circle at an outer point, waiting for a clearance behind some aircraft that took the above procedure while still some distance out. Although this requires the minimum of equipment usually required at the terminal airport anyway, such a procedure makes no point of type of aircraft except as to ability to communicate and navigate a precise approach path, even if VFR!

It may be pointed out that this does not touch on the so-called "little fellow" who is considered by one side to be a hazard while in the general operating area of low visibility, and by the other side, as having his rights infringed upon by any requirement for controlled flight, if not enroute to the terminal airport.

If we concede that he is a hazard while in the *general* operating area of the high density terminal airports in marginal visibility, let us not lose sight of the fact that the big aircraft enroute to the terminal airport should, of necessity, be restricted to the electronically aligned airway approach paths and to altitudes in accordance with those procedures. These routes are so designed that they provide such ample separation that a wide-wandering pilot on instruments will not conflict with a neighboring route. If the condition is low forward visibility only, deviation from the limits of these routes cannot be excused.

Hence we have whole blocks of airspace, between and occasionally under these "corridors," that could be reserved for the other pilot. This would enable him to approach or depart from his "local airport" with a minimum of inconvenience. During wartime, similar restrictions placed virtually no strain when weather as a safety factor was not the issue. Is it too much to ask that a through-flight detour around or over these areas in marginal conditions rather than jeopardize the operation of both classes of arrival and departure aircraft?

In conclusion, the institution of a five-mile visibility restriction in congested terminal areas, *if confined to specific approach and departure lanes,* and requiring a minimum standard of pilot and equipment qualification and the segregation of such traffic from all other traffic *otherwise unhampered,* may be worth giving a good try, with all parties contributing positive ideas and cooperating to exhaust its possibilities in the interest of continued safe operation.

"JEP" Manual for the VFR Pilot

It is not surprising that, with the welter of fine print and voluminous pages of numerous separate publications by the government, through which a pilot must wade to extract even a small bit of navigational or airway information, a company like Jeppesen has made its name unique, blessed and profitable throughout the aviation industry. Even such a hold-out among the major air carriers as American Airlines has succumbed to the easy way and is gradually becoming more and more reliant on "Jep" to supply its navigational needs.

Until the present, the field open to "Jep" has been exclusively the airline pilot or his equivalent, the professional big-ship executive pilot engaging in cross-country IFR and low instrument approaches as a daily chore. Now it has been announced that the government is contemplating the elimination of radio navigational data from its familiar Sectional Charts. This decision is causing no little concern among the many pilots who find this data a life saver when, by virtue of sparsely landmarked terrain or under marginal visibility conditions, the topographical presentation is inadequate.

Many pilots have made reference to the comparatively economical Coast and Geodetic Radio Facility charts and have expressed the wish that they could have this data combined with Airmen's Guide info. and Flight Information Manual material in one easy-to-use volume, instead of having to carry a full library of fine print. Many pilots have never crossed the Mississippi River in their wanderings and don't contemplate doing so and so have hesitated to subscribe to such voluminous offerings to meet their limited needs.

So "Jep" comes to the rescue. For the VFR pilot, the private-plane pilot and, we suspect, a lot of other pilots not mentioned, "Jep" now offers their Radio Air-Route Guide. In a binder clearly reminiscent of the well-known Airways Manual, Jeppesen offers Radio-General Direction and Position Finding Facilities, including a cross ndex of navigation facilities, VOR procedures, and all radio facilities arranged by identification, location and frequency.

Under Meteorology Data, they offer Service "A" operational weather schedules, Teletype symbols, reporting sequences and relays. Under ATC, they include both VFR and IFR procedures, airport procedures and radio communications and, of course, CAR 60—Air Traffic Rules.

Pleasantly surprising is the fact that included are the Radio Avigation (Enroute) Charts, lately introduced to the Airways Manual users and the handiest aid to cross-country yet produced, surpassing by far the almost useless C. & G. topographical Flight Charts. The Enroute charts give enroute minimum altitudes (a handy aid for VFR pilots in strange country who could not otherwise know when it was advisable to abandon VFR flight operations without concern regarding a premature decision to turn back), mileages, frequencies, reporting points, course, control areas and danger areas. Also included are handy Nautical/Statute Mile conversion tables. The Jeppesen accordion-type manner of folding these charts makes it possible to select any limited area along your route by thumbnail and to cover nearly a 2,000-mile flight without ever having more than 9 inches of map spread open. You can open the whole thing in a *Cub* cockpit without losing control of the airplane.

"Jep" also includes very valuable flight planning charts with both the Victor (VOR) and LF range airways routes, designators mileages, flight-plan data guides, and an airways communication guide.

In case you find both Sectional Locals and the more comprehensive Enroute charts too confusing in high-density areas, "Jep" provides local area charts with radio, navigational and ATC information printed in very clear detail.

A hidden blessing gadget is the "stay open" bar which pulls up horizontally from the bottom of the binder and transforms the manual into a firm 16 x 8½ inch open guide which will either rest easily on your lap (without slipping down between your knees when you are on approach) or stay open on the seat beside you (without flipping pages automatically if you have a cockpit ventilator open). Indeed, blessed be the new "Jep!"

Emergency Airport and Runway Data Released

The Washington office of CAA has released for the guidance of air carriers and operators employing similar type equipment, a list of the airports and runway lengths considered minimum for safe landing under emergency conditions, *i.e.* Air Defense alerts, fire in aircraft, engine failure, alternates other than those certificate-approved, etc. Sole consideration is acceptability for a safe emergency landing rather than emergency facilities—fire and crash equipment, etc. Factors such as load vs. elevation, temperature accountability, runway gradient, wind and local obstruction data have not been taken into consideration, because airports and runways meeting these considerations hardly need be classed as emergency alternates.

Although primarily designed for air-carrier guidance, it is felt that, inasmuch as pilots of non-scheduled cargo or business aircraft are often their own dispatchers, this information is of interest. The values quoted are based on graphs that pilots should have in their Airplane Flight Manuals, and are calculated to 70% (alternate airport) requirement and, in the case of landing runway lengths, maximum allowable gross landing weights at sea level, 500- and 1,000-foot elevations: (Note: Although many of the aircraft listed are not as yet operated by other than scheduled air carriers, the full list is given for general interest.)

Aircraft	Landing Length (ft.) S.L.	500′	1000′
Boeing 377	5500	5600	5670
Lockheed L-1049	4780	4840	4900
Douglas DC-4	4540	4595	4660
Douglas DC-6A&B	4430	4480	4560
Lockheed L-649 & 749	3975	4030	4080
Douglas DC-6	3850	3900	3950
Convair 240	3370	3410	3460
Martin 404	3360	3400	3450
Convair 340	3350	3380	3405
Martin 202	3325	3375	3425
Lockheed L-049	3140	3200	3240
Douglas DC-3	3120	3150	3190

Considering the capabilities that pilots often demonstrate under stress of circumstances outside of their control, it would not be too surprising to some day find a Connie that couldn't make it into the big airport for lack of time or altitude, parked on Chicago Lake Front (Meigs), Zahn's in New York or Alexandria in Virginia near Washington, D. C.

Examples of airports in the northeastern United States that could be suitable for such emergency aircraft operations are indicated in the box below:

CITY	AIRPORT	LONGEST RUNWAY	LARGEST TYPE AIRCRAFT
Augusta, Me.	Augusta State	4205	DC-6
Baltimore, Md.	Harbor	4535	DC-6 A & B
Bar Harbor, Me.	Bar Harbor	4500	DC-6 A & B
Bowling Green, Ky.	Warren County	4000	DC-6
Clarksburg, W. Va.	Benedum	3719	Convair 240
Danbury, Conn.	Danbury	4422	Connie
Easton, Md.	Easton	4000	DC-6
Erie, Pa.	Port Erie	4595	Connie
Fall River, Mass.	Fall River	3500	Convair 240
Johnstown, Pa.	Johnstown	4500	Connie
Linden, N. J.	Linden	4100	DC-6
Lock Haven, Pa.	Cub Haven	3350	DC-3
Malone, N. Y.	Malone	4000	DC-6
Martinsburg, W. Va.	Martinsburg	5000	Super-Connie
Rutland, Vt.	Rutland	4000	Convair 240
Zanesville, O.	Zanesville	5000	Super-Connie

Flyers' Guide To Los Angeles Area Offered

A helpful brochure to visiting pilots has just been published by a group of public-spirited Southern California organizations. Called the "Flyers Guide to Greater Los Angeles," the booklet was prepared by the California Aeronautics Commission, in co-operation with the Los Angeles Chamber of Commerce, and published by the Pacific Airmotive.

To the credit of the skillful pilots who have grown up in the tradition of this area's definition of "VFR", there have been remarkably few recorded instances of mid-air near-collisions. Nevertheless, to the stranger who has had the "exhilerating" experience on instrument approach let-down of seeing a shadowy shape slip ghost-like across his nose and been subsequently advised that it was "VFR traffic", this brochure will be most enlightening.

In all seriousness, it may be that if all pilots not on controlled ATC clearances were to abide by the very specific suggestions made in the booklet, there would be no excuse for any conflict with the controlled aircraft. But how to obtain separation from other "VFR" flights while descending through or to be legal if visibility in the smog (unreported) turns out to be less than one mile is not explained. Further, the booklet states that "it is *nearly* (Ed. Italics) always possible to distinguish objects directly below on the ground". Also, "if the top of the smoke is 4,000 feet or higher, spiral down over *open country* (we hope this is done "off airways"—Ed.) and check visibility at lower altitudes".

It is our hope that this booklet will find its way into the hands of every pilot contemplating flight into the area; especially the pilot on IFR plan who may be encouraged to ask for *radar advisories* and listen to them during his approach!

If the suggestions and information given are followed by pilots of experience, judgment and with due regard to the limitations imposed by Civil Air Regulations, the excellent record for the area operations should be enhanced rather than broken.

The booklet also lists radio data and flight plan procedures.

The map reproduction included, although pilots are warned to avoid its use for navigation, lists a key to all the prominent landmarks in the area and indicates the area of heaviest smog. Copies are available without cost and *should* be obtained by writing PAC, 2940 N. Hollywood Way, Burbank, Cal.

SKYWAYS

AIRPORT SERVICE GUIDE

An up-to-date, accurate, detailed listing of aircraft services and products available to single and multi-engine operators throughout the U.S.

MONTANA

GLASGOW—Valley County Municipal Airport—*GLASGOW FLYING SVCE:* Hangar strage $1 nite, $15 mo; tie-dwn; *TEXACO* 80-91; line svce 8 a.m. to 6 p.m.; A&E; major radio & airframe, minor eng. Dealer: *CONTINENTAL, LYCOMING, NARCO, PIPER-STINSON,* Sorenson spray units. Taxi, pilot lnge, Texaco crdt crds. Food & Lodging Glasgow. Airport: 3 mi NE; el 2298; lat 48-13, long 110-15; no lndng fee; lights, beacon; 3 rnwys, longest 8800; obstr: P-line N. Orvan Sundby Mgr.

MILES CITY—Miles City Airport—*MILES CITY AERO SVCE:* Hangars up to small twin, rates $1.50 to $6.50; no tie-dwn fee; *STANDARD* 80-91-100; line svce 24 hrs, A&E; major & minor sing-eng, light main multi-eng; major & minor airframe light arcrft; wash, polish, paint, clean; Continental, Lycoming eng prts. *PIPER* dealer. Food on arport; lodging Miles City; pilot lnge; Standard and affiliate crdt crds. Airport: 2 mi SSW; el 2630; lat 46-25, long 105-52; no lndng fee; Insac 24 hrs; teletype, weather, beacon, lights; 2 paved rnwys, each 5600. C. R. Ugrin Mgr, Tel 1931. Airline: NWA.

MISSISSIPPI

CLARKSDALE—Fletcher Field—MISSISSIPPI. *VALLEY AIRCRAFT SVCE:* Metal hangar, $1.50 to $3 nite; no tie-dwn fee; *ESSO* 80-90; line svce 8 a.m. to 5 p.m., except Sun; A&E; major all types civilian arcrft; major airframe, minor instru & radio; complete eng overhaul shop, prts for Continental 220 & 240 hp radial, 225 & 300 hp Lycoming, *P&W R985.* Dealer: all *CESSNA* models; wash, polish, paint, clean. Taxi. Food & lodging Clarksdale. Airport: 8 mi N; el 175; lat 34-17, long 90-31; no lndng fee; Southern Airways radio; lights, beacon; Little Rock sect cht; 2 paved rnwys, longest 4000; obstr: 30-ft tr S, hngrs, other bldgs SW. Airline: SOU.

MICHIGAN

DETROIT—Detroit City Airport—*BEACON INSTRUMENT SVCE:* Instruments & accessories; dealer: *KOLLSMAN, ECLIPSE-PIONEER, LEWIS;* CAA sta 3738; major instru repair, sales, svce, 8 a.m. to 5 p.m. Tel, Lakeview 6-6040.

ANDERSON AIRCRAFT RADIO CO: Distributor: *BENDIX, ARC,* Associate dist *NARCO.* Service: arcraft communica eng, screen room, omni test equip, ILS, ADF, specialize custom executive install. Tel, Venice 9-6700.

Airport: 5.5 mi NE; el 619; lat 42-24, long 8301; lndng fee corp-owned arcrft; control tr, radio, teletype, weather, arprt of entry; lights, beacon; 4 paved rnwys, longest 4585; obstr: gas tank W. C. V. Burnett Mgr, Tel LA 6-5875.

VERMONT

RUTLAND—Rutland Municipal Airport—*RUTLAND FLYING SVCE:* Steel-frame hngr, strage sing & small twin $1.50 nite; no tie-dwn fee; *ESSO* 80; line svce daylight hrs only; part-time A&E; minor sing & multi-eng; radio svce on call; wash, polish, interior clean; Esso crdt crd. Taxi, bus, courtesy car. Food at arprt, 1 mi N; lodging 1 to 2 miles, Rutland hotels. Airport: 2 mi SSE; el 785; lat 43-31, long 72-57; no lndng fee; unicom 122.8 arprt hrs only; homing beacon 6.7 NW, 23 hrs; Albany sect cht; 2 paved rnwys, longest 4000; obstr: hills E, lighted nite; lights, beacon. W. Bardsley Mgr, Tel 1874; Airline: CAI.

MASSACHUSETTS

NORWOOD—Norwood Municipal Airport—*WIGGINS AIRWAYS, Inc:* Concrete hngr; *ESSO* 80-91; line svce day, 10 mechanics; major & minor sing & multi-eng; major overhaul Continental, Lycoming, Franklin, Jacobs; major airframe, minor radio, replacement instru; wash, polish, paint, clean; complete aviation supply house. Dealer: *CONTINENTAL, LYCOMING, FRANKLIN, LEAR, deH DOVE; PIPER* distributor. Taxi, U-Drive-It on call. Food 1 mi 7 a.m. to midnite; lodging 2 miles & Boston hotels; pilot lnge; Esso 7 airline crdt crds; CAA dist office admin bldg. Food to go delivered to arcrft 1 hr notice. Airport: 2 mi E Norwood, 14.5 mi SSW Boston; el 52; lat 42-11, long 71-00; unicom 128.8; beacon. Paved rnwy 4000. John W. Phillips Mgr, Tel Norwood 7-0106.

LAWRENCE (North Andover)—Lawrence Municipal Airport—No hngrs, no tie-dwn fee; *MOBILE & ESSO* 80-91; line svce 8:30 a.m. to dusk; A&E; major sing-eng, minor multi-eng; major light arcrft airframe, minor radio & instru; eng prts light planes; wash, polish, paint, clean. Taxi, limousine, *HERTZ,* bus. Food across from term bldg noon to 1 a.m.; lodging nearby Mobil & Esso crdt crds. Food to go delivered to arcrft on notice. Airport: 2.5 mi ENE Lawrence; el 165; lat 42-43, long 71-07; lndng fee for charter, cargo flights $1.50 to $3. unicom 122.8; lights, beacon, Boston sect cht; 3 paved rnwys, longest 4000; obstr: chimney SW, P-line SSE. John E. Sinclair Mgr, Tel Lawrence 3-7512. Airlines: EWA, NEA.

OREGON

KLAMATH FALLS—Klamath Falls Municipal Airport—3 hngrs, $1 to $5 nite; no tie-dwn fee; *SHELL & STANDARD* 80-91-100; line svce 5.30 a.m.-8 p.m., on call; A&E; major & minor sing & multi-eng; minor radio & instru, major airframe; eng prts Piper, Beechcraft, Continental, P&W; wash, polish, paint, clean. Dealer: *CONTINENTAL, BENDIX, SCINTILLA, LYCOMING, NARCO, LEAR, PIPER, BEECHCRAFT, CESSNA.* Taxi, courtesy car, Tel 2-1234, 5580; weather; food on arprt 6.30 a.m.-6 p.m.; lodging Klamath Falls; pilot lnge; Standard and Shell crdt crds. Food to go delivered to arcraft on notice. Airport: 5 mi SE; el 4085; lat 42-09, long 121-43; no lnding fee; radio facilities, beacon, lights, teletype; Klamath Falls sect cht. Paved rnwys: 3, longest 7134. Russell Avery Mgr, Tel 3272. Airlines: UAL, WCA.

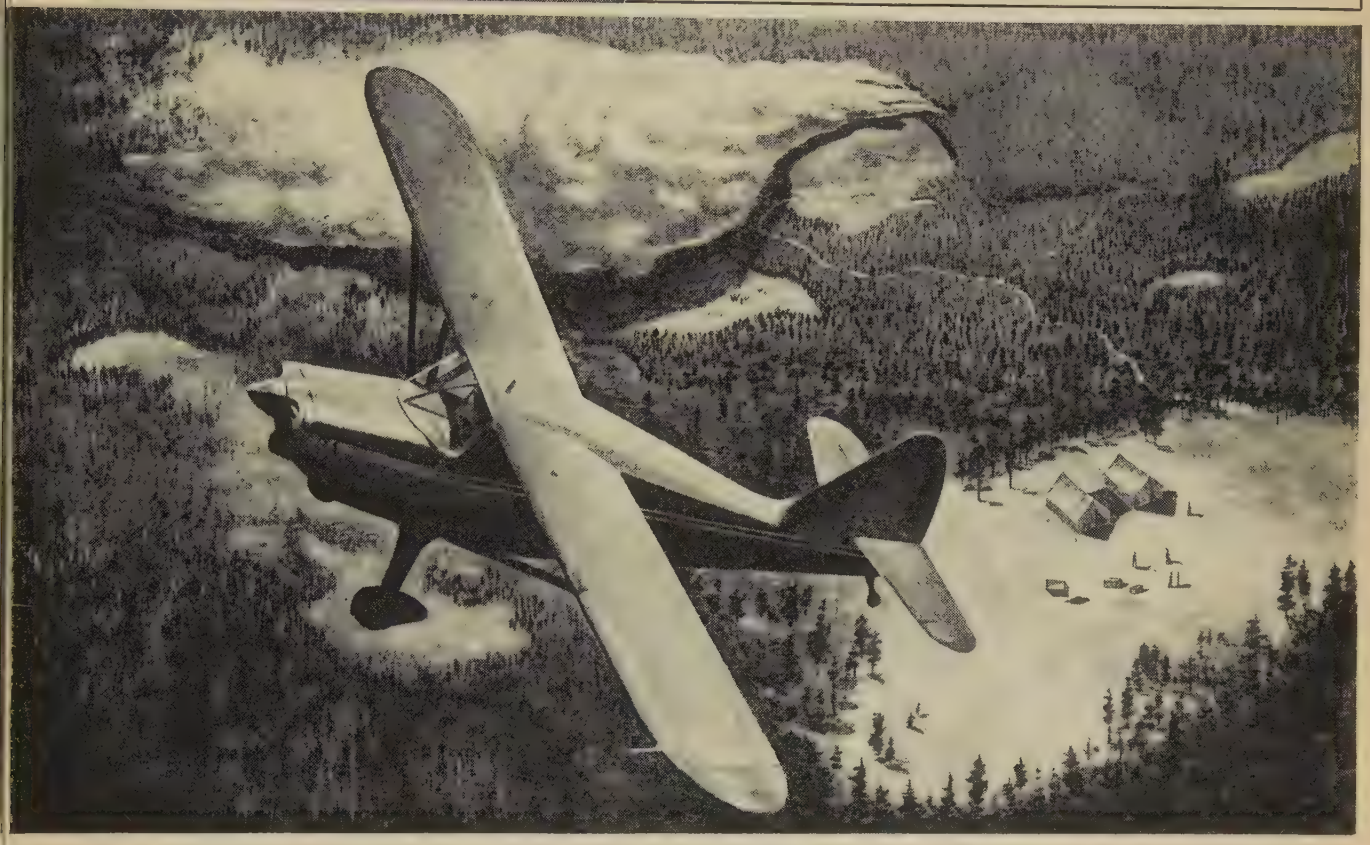
PENNSYLVANIA

READING—General Spaatz Field—*READING AVIATION SVCE:* 2 hngrs; tie-dwn; *CITIES SERVICE* 80-91-100; line svce 7 a.m.-11 p.m.; A&E 8 a.m.-9 p.m.; major & minor sing & multi-eng, incl major electronic & communica install; eng prts; major airframe, radio & prop, minor instru; wash, polish, paint, clean. Dealer: *P&W, GYPSY QUEEN, CONTINENTAL, LYCOMING, ARC, LEAR* (incl auto pilots), *BENDIX, NARCO, deH, NAVION, RILEY TWIN NAVION.* Taxi, *HERTZ.* Weather, teletype; tel 3-5255; food on arprt 7 a.m.-9 p.m.; lodging adjoining arprt; pilot lnge; Cities Service crdt crds. Food to go delivered to arcrft on notice. Airport: 3 mi NW; el 342; lat 40-22, long 75-58; no lndng fee; control tr, adm bldg; beacon, lights, field mrking; radio range, ILS. Paved rnwys: 3, longest 5150; clear approaches. Melvin H. Nuss Mgr, Tel 3-7228. Airlines: CAI, CAP, TWA.

PLANE FAX

Your Best Week-end Flight Plan for January

Fly to Los Angeles for the Rose Bowl game and the Tournament of Roses parade. Plan to land at any of the airports near Pasadena that carry quality Standard Oil Aviation products. Refer to your Directory of Standard Airport Dealers for their names and locations.



Fighting Fire From The Air

The eyes of the fire boss! Dropping strategy maps and food to the fire camp and relaying radio instructions to fighter crews is routine for Mr. and Mrs. Lonnie Pool when fire breaks out in the timberlands near Ukiah, California. They patrol more than 2,500 square miles of state and private forests from their base at Ukiah Municipal Airport, flying 240 miles on each normal patrol.

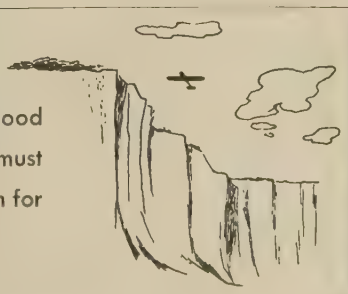
"Our kind of flying takes a lot of power," says Mr. Pool, "especially to climb out of canyons after dropping food from 10 feet altitude at low speed. We've found that Chevron Aviation Gasoline 80/87 gives us plenty of extra power when we need it. And Chevron 80/87 adds to our safety because it never fouls spark plugs—a trouble we often had when we used gasolines with higher lead content.

"Because we're safety-conscious, we use New RPM Aviation Oil in our engines—we never experience pre-ignition or rough running due to oil. New RPM Aviation Oil cuts wear, too. When we opened our Stinson's 165 H. P. Franklin engine for the first time after more than 1000 hours, the cylinders and pistons showed practically no wear."

T.M.'S "RPM", "CHEVRON," REG. U.S. PAT. OFF.

TIP OF THE MONTH

If you are flying in the mountains, it's a good idea to stay to one side of any canyon you must fly through. That way, you'll have more room for a 180° turn in case you have to head back.



CHEVRON AVIATION GASOLINE
NEW RPM AVIATION OIL
STANDARD OIL COMPANY OF CALIFORNIA

Learstar Conversion

(Continued from page 11)

Wool Tufts, glued to the wings and other surfaces, and photographed in flight, gave Dr. Raspet and Lear Pilot Ed Swearingen a visual picture of the regions where separated flow existed and showed how laminar flow could be increased by use of geometric boundary layer control.

Dr. Raspet's glide tests were not the only proof that Lear was on the right track —he utilized facilities of the California Institute of Technology's wind tunnel for lengthy studies of other configuration changes to develop highly improved laminar flow patterns.

While the "Learstar" modification project really goes back two years to when Bill Lear first seriously considered "hopping-up" his *Lodestar,* he dates it back properly to April, 1953, when the idea occurred to him to go into "Learstar" modification commercially so other business executives could benefit from what he had learned.

Lear personally conducted the early experiments in modifying the Model 18 and spent nights in the hangar with tin snips fashioning cowl flaps to further streamline the engine nacelle, which came with a fixed gap fine for slow flight but with high drag at high-speed flight.

Convinced by a resultant significant speed gain that he was on the right track, Lear hired Gordon Israel, former Grumman Aircraft Engineering Corp. assistant chief engineer, to take over the project.

About that time the Aircraft Service Division of Lear came into being to handle "Learstar" conversions specifically, and also the buildup of other executive-type modified aircraft at the Santa Monica hangar.

Israel went full-speed ahead into the "Learstar" program and assembled a competent engineering staff, only one of its kind devoted exclusively to executive transport modification work.

To begin with, customers who brought their *Lodestars* to Lear for conversion were guaranteed a complete strip-down and cleanup with all engineering changes prescribed by the CAA for an 8,000-hour overhaul.

Israel's first modification job was to complete the engine-nacelle project started by Lear, a project that included sealing the retracted main landing gear inside a triple-door streamlined fairing, modifying the original NACA cowling design, moving the engine mounts outboard three inches and changing the carburetor air intake and engine exhaust ducting. The exhaust collector rings were eliminated, and a new heat source for cabin air, windshield defrosting, etc., provided with a 100,000 btu Janitrol internal combustion heater installed in the fuselage.

Carburetor air, taken from the pressure area within the ring cowl forward of the cylinders, was bought in through a better streamlined scoop. The impact of air striking the cylinders tends to "knock" moisture and dust particles from the airstream before it hits the intake opening.

The old single exhaust trough of the *Lodestar* was replaced with three smaller troughs, two outboard and one inboard, each serving three cylinders through a siamese and a single stack. The stacks were individually covered with cowl flaps controlled electrically by a Lear, Inc., actuator.

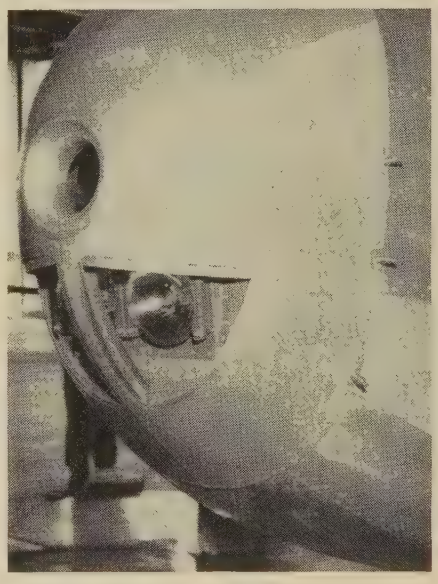
A quick-removal feature of the ring-cowl, using only four over-center toggle latch attachments, made possible removal of the assembly in a few seconds for inspection or maintenance.

Israel also incorporated a new augmenter exhaust system attached to only the engine to provide a fully free-floating installation and cut down on vibration.

Other power section modifications included a new dishpan and diaphragm, and new, larger Lord Dynafocal engine mounts with shock elements four times the size of the originals.

Israel also rearranged the engine breather and vacuum lines to exit overboard in a common outlet behind the nacelle fairing.

Another major vibration-reduction innovation was the outboard shift by three inches of the whole power unit, giving a four and a half-inch clearance between prop tips and fuselage, compared with the original one and a half inches.



LEARSTAR *nose houses two taxi lights and a four-inch bell mouth air intake orifice*

The effect was to reduce the noise level considerably inside the fuselage and at the same time provide an aerodynamically improved flow of air with less turbulence along the fuselage skin.

Modification of the paddle-bladed Hamilton Standard full-feathering 33D50 propellers included installation of a dual-capacity governor (model 4G8G30M) with an electric control head, installation of an electric pitch control for high-low rpm actuation from the cockpit, a new electric prop feathering pump and rheostat control for the alcohol anti-icing system.

Israel reworked the main gear assembly and added a landing light fixed to the main strut to eliminate the high-drag wing light installation. Goodyear Tire and Rubber Co. wheels were modified with expansion rings to take bigger tires capable of handling loads up to 22,500 pounds gross weight.

The landing gear was further changed by installing a new type mechanical up-lock and down-lock system, spot-type brakes, new high-pressure hydraulic hose and an emergency nitrogen landing gear extension system.

This entire engine nacelle conversion provided the major aerodynamic cleanup for the "Learstar," but more was to come in smaller increments, to give the entire modification its unusual performance.

Starting from the nose and working back to the tailcone, Israel began with a new plastic nose section now housing two taxi lights, but originally designed to house, in addition, two ADF units (later shifted to inside the plastic fairing ahead of the empennage). In the center of the nose is a four-inch bell-mouth air intake orifice—the only one on the whole aircraft—replacing the original numerous air intakes.

Israel further refined Lear's idea for a curved plastic windshield made of thick, "bird-proof" Sierracin, especially constructed by the Sierracin Corp. of Burbank.

The original *Lodestar's* windshield had a broken contour line that accounted for considerable drag, while the new one-piece canopy offers better visibility, less drag and greater strength and safety.

All outside "clothesline" antennae were eliminated to cut parasitic drag. The ADF loops, as mentioned earlier, were hidden inside the plastic fairing ahead of the horizontal stabilizer.

The "Learstar's" tailwheel was designed by Israel to be fully retractable. It folds up behind a triple door, rearward, into an 18½-inch extension of the tail cone section. For safety in ground handling—particularly in take-off and landing operations—a tailwheel swivel lock was designed to remain locked or to lock automatically when the wheel reached trail position, except when the control column was moved full forward. This arrangement successfully prevented the possibility of a pilot inadvertently taking off or landing with the tailwheel unlocked or in full swivel position.

Due to the "Learstar's" increased speed, the horizontal stabilizer had to be given a 1.8° increase in incidence to offset the tendency to climb (because of greater lift from the wing at higher speed), and to eliminate the drag and resultant "nibble" that a slight down-elevator angle produced.

Stabilizer tip extensions as originally constructed were found unnecessary and contributory to the drag problem, hence were chopped off to six-inch stubs. The airflow interference between horizontal and vertical stabilizers was smoothed out further with bullet fairing projections ahead of the intersections. Earlier NACA and British research showed that this method worked well in reducing interference drag by speeding up the air flow before it passed over the intersection of surfaces.

The original *Lodestar's* basic wing design, at first glance, was not appreciably changed in the "Learstar" speed conversion, but actually, throughout the airfoil, an accumulation of changes added up to a significant reduction of drag over the entire wing. In addition to removal of the landing light installation to the main gear strut, navigation lights were imbedded in streamlined plastic enclosures forming part

(Continued on page 38)

NOW EVEN *finer* ... AMERICA'S MOST POPULAR FOUR-PLACE BUSINESS PLANE

Tri-Pacer FOR '54

More for '54—all yours in the great, new Tri-Pacer, the plane that so well combines safety, flying ease and useful cross-country performance with practical economy.

Now with new beauty, new comfort, many other new features, the Tri-Pacer is even more the logical choice for YOU—especially if your business will benefit when you can get more done in less time.

Only in planes costing over twice as much do you get some—*not all* —of these features ➤ tricycle landing gear ➤ simplified, inter-connected controls ➤ outside baggage door ➤ separate front and rear doors ➤ cargo conversion in 15 seconds ➤ Duraclad finish ➤ economical Lycoming power ➤ over 120 mph cruising speed *straight* to your destination.

"PLUSH" is the word for the new Tri-Pacer interior, with styling to suit the most discriminating taste. New foam rubber seats (front seat adjustable) give easy-chair comfort. Thorough sound-proofing adds further to quiet, restful flight.

See the new '54 Tri-Pacer at your dealer's today . . .

SEE WHY SO MANY

Pick PIPER

Send for brand new full-color '54 Tri-Pacer and Pacer brochure Dept. 1-K

PIPER AIRCRAFT CORP.

Lock Haven, Pennsylvania

Learstar Conversion

(Continued from page 36)

of a modified, squared-off wingtip.

The original fixed slots were sealed over, as they were found to cost 6 mph in speed and, in addition, are subject to dangerous icing.

To give satisfactory stall and minimum-speed characteristics after removal of the slots, Israel built into the "Learstar" a modified "droop-snoot"-type leading edge along the outer wing section to increase the camber and produce a laminar flow over the upper surface at high angles of attack. He says the resultant stall and low-speed characteristics are actually better than those of the original configuration.

Israel, who contributed heavily to development of the droop-snoot for the Grumman *Panther* jet fighter, says the feature cost the "Learstar" only 1 mph in airspeed and gives a net increase of 5 mph over the slots.

Feather-edge de-icer boots were substituted for the old riveted boots and further streamlining was achieved by fairing the wing's lapped skin joints with a special Minnesota Mining Co. compound (EC1180).

Flap travel was reduced to 55% of the original, since *Lodestar* pilots rarely, if ever, use more than this amount of flap, due to the fact that more flap provides negligible additional benefit, while creating a condition of dangerously excessive control pressures in event of a go-around.

This restriction of flap travel to 55% made possible removal of the familiar *Lodestar* "batwings" and external Fowler flap tracks, and the retracted flaps were feathered into the trailing edges of the wings. Airflow over the leading edges of the retracted flaps was stopped by installing extruded tubular rubber seals.

Airflow creeping around the ailerons as well as empennage control surfaces was eliminated by adding special brushes made by the Fuller Brush Company.

Contemplated but not yet completed is a set of extra fuel tanks for the outer wing panels, to extend from a position 12 inches outboard of the engine nacelles to mid-span of the ailerons, each tank holding 220 gallons. These, Israel says, would extend the "Learstar's" range to 3,000 miles. The fuel-system rework also included a thorough cleaning and resealing of the original wing tanks with EC601 compound, the work being subcontracted to Aircraft Tank Service, Inc., of Burbank.

Inside the aircraft, the modification story was one of working out the last details of a perfect "pilot's airplane": a clear, flush cockpit floor with thick rug, a clean ceiling free of dangerous projections, a redesigned functional control column and reclining Aerosmith pilot seats made for sound-proofed comfort for lengthy cruises.

Arrangement of the instrument panel was, of course, a matter of customer preference, but in Lear's personal ship everything was placed within easy reach of both pilot and copilot.

Rework of the *Lodestar* cockpit produced other changes, such as addition of a new type continuous reading fuel-indicating system for the new dual-type fuel supply, converted from the standard Lockheed type to the CAA-certificated system now approved for airline use.

Two electric fuel booster pumps were also added, aft of the engine firewall, to serve as auxiliary fuel pumps for the main fuel-supply system.

Incidentally, the modification called for removal of all electrical wiring from the airplane and substitution of new approved electric wire marked to conform to supplied blueprints.

Access to the cockpit was made simpler and less acrobatic by dropping the front wing spar a full eight inches and removing the bulkhead behind the pilot seats. Dropping the spar, says Israel, actually was a relatively simple structural change.

In the Lear configuration, a galley comes next, and than a spacious, luxurious executive cabin for 10 passengers, complete with a bar and television set.

Result of this preliminary modification project of the *Lodestar*-to-"Learstar" was such that Lear doesn't hesitate to guarantee 270 mph true air speed at 10,000 feet on only 58% power (750 hp per engine with the Wright 1820 series 1275-hp engines).

In fact, Israel and Lear made a little personal bet that the "Learstar's" top cruise speed will soon be increased—Lear offered to pay Israel $200 for every mile added above 280 mph and Israel said he'd pay Bill $100 for every mile under 280! (Israel says it's a cinch bet.)

Regardless of how much more cleanup these men dream up, they already have created virtually a new executive transport for America's fast growing group of business leaders who find it economical to travel via their own aircraft.

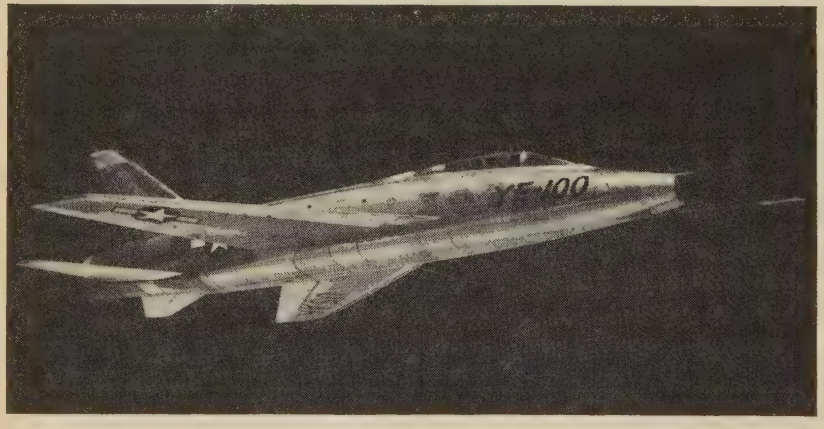
Norman Warren, Lear's Director of Advertising, insists that "it can be clearly demonstrated that no twin-engine plane flying today will carry as many people, as fast, as far, as comfortably, into as many airports, and with as little maintenance as the "Learstar" conversion—regardless of price." Confidence of the Lear staff, actually, is based on already achieved performance, so you can forgive them such enthusiasm.

Lear believes there is a good field ahead for "Learstar" conversions because, of the 625 original Model 18 *Lodestars* built by Lockheed, 270 are now in commission and 225 of these are in the United States.

Lockheed's excellent original design gave the Model 18 top transport performance more than a decade ago as the result of more than 200,000 design engineering hours. Lear's men have added tens of thousands of hours of engineering study to bring the "Learstar" up to date through application of new knowledge such as that supplied by Dr. Raspet.

Originally used widely as a military troop transport, glider tow ship, hospital plane and whatnot, the old *Lodestar* has emerged as the newest and most sensational executive aircraft now available to businessmen who need to get around to odd places in a hurry, and with economy.

And you can blame it all on Bill Lear's passion to whip drag, and Israel's ability to engineer his boss's ideas into reality.



SUPERSONIC AIR SUPERIORITY FIGHTER

"I'm going to kick her in the tail."

Within a few seconds after that message was radioed into Operations at Edward Air Force Base by Lt. Col. F. K. (Pete) Everest, 33-year-old Chief of the Flight Test Operations Laboratory, his swept-wing jet fighter streaked through a nine-mile measured course to set a new world's speed record. Speed of that run, made down on the deck, was 767 mph, pushing his average for the two fast passes to 754.98—the new mark.

His aircraft was the North American F-100 *Super Sabre*, newest member of a new post-war family of operational supersonic jets. Powered by a Pratt & Whitney J57-P7 turbojet engine with an afterburner which provides the "kick in the tail," the F-100 has a service ceiling over 50,000 feet and a combat radius of 500 nautical miles. It has a span of 36 feet, over-all length of 45 feet and over-all height of 14 feet—the big, fast brother of the F-86 *Sabrejet*. Sweep back of wing and tail is 45°. It is an air superiority fighter designed for maximum climb, maneuverability, altitude, and speed.

Pictorial–Symbolic

. *(Continued from page 17)*

almost stagnant in the type of indication. Horizons grew smaller, then larger, then smaller; they changed from a bar to a ball, back to the bar; and are now tending again toward enlargement. In every stage the gyros were improved; legibility was improved; lighting was improved; but the same basic presentation always remained. In one instance the sensing was even reversed, but was soon changed back.

As aircraft became more complex, the instrument panel became more crowded. Each bit of information was added as it became necessary, but nothing was ever removed. Instrument flying became more common and, with some exceptions, most aircraft fly today in all but extreme weather conditions; but not without a tremendous amount of training and continuous refresher, and not without a great deal of effort on the part of the pilot. Some pilots will deny that instrument flying is difficult and perhaps for these pilots it really isn't a problem. For the average pilot, however, it is an effort which requires almost constant training to maintain proficiency.

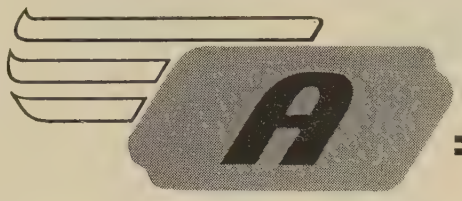
One of the reasons for this training requirement is the fact that from symbols it is difficult to visualize that which we are used to seeing. Symbols must be memorized and must be related to some basic visual cue to which we are accustomed. This calls for additional training just to learn what the symbols represent. Wouldn't it reduce the training problem to eliminate the symbols and replace them with a reproduction of these visual references?

Another reason for the difficulty of instrument flying is due to our physical make-up. Man was not designed to operate efficiently without full use of all of his senses. The strongest of our sensory systems is vision. In maintaining balance, it is the visual sense which supplements and refines the inadequacies of the proprioceptive and equilibrium senses. For example, when making an ordinary turn in an aircraft under visual conditions, there is no apparent feeling of instability nor does this feeling exist when the turn is stopped and the plane rolled out to level flight; yet when under instrument conditions this same maneuver sometimes produces vertigo. The physiologists tell us that this is due to the inertia within our vestibular apparatus which upsets our balance and produces this vertigo. It can be established from this that the information which we receive from the artificial horizon and directional gyro is not strong enough to overcome this feeling of unbalance. It can be stated, therefore, that if the horizon were designed to reproduce the visual cues which are apparent under visual conditions, vertigo probably could be eliminated.

Looking at this from the symbolic side of the argument, it would appear from past experience that proper training would take care of this problem. This is true in most instances but the cost of the initial instrument training plus the refresher training greatly increases the total cost of pilot training. Since we start by training the man to fly by using visual reference, why not

(Continued on page 40)

= radio service and installation—finest in the East—*right at Reading.*



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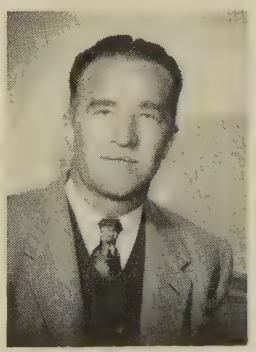
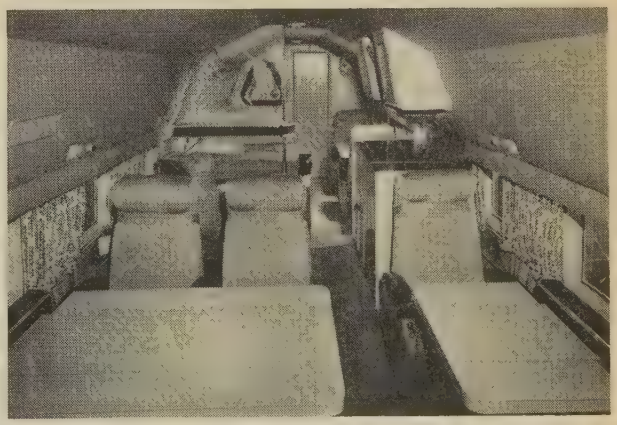


MR. DON BEELER
Chief Pilot
Delhi Oil Corp.
Dallas, Texas



An interior view of the Delhi DC-3

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PRESIDENT

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SYMBOLIC PICTORIAL COMPROMISE

Pictorial–Symbolic

(Continued from page 39)

try to reproduce these same references rather than recondition his reflexes to a completely different set of cues. The present method is like teaching a person to play music by ear and then forcing him to read notes during a concert.

An experiment was carried out some years ago in which students were taught to fly only by instruments, starting with the initial flight. Although it required considerable training, it was found that the students became quite expert in handling the plane. Upon removing the hood, however, the students were quite disoriented and incapable of making a landing.

Now exactly what does this prove? Some will say that it proves conclusively that symbolic presentation is adequate to fly an airplane. With enough training this is true *providing* everything goes according to plan without change or without an emergency and if we have reliable equipment to produce the necessary signals throughout the entire flight, from take-off to a completed landing.

Another type of experiment was carried out within the last 10 years in which students who were qualified in basic flight were placed under a hood and supplied with pictorial presentation of attitude and direction. In this experiment it was found that these students were capable of maintaining attitude, direction, and altitude, with very little effort within the *first* 10 *minutes of flight.* When the hood was removed, these students were quite capable of landing the airplane.

What does *this* prove? It very definitely proves that if the presentation is similar to visual reference, the ability to fly straight and level on instruments requires very little additional training beyond the basic visual flight training. There is nothing to be unlearned because the student is essentially flying in the same way that he flies under visual conditions. Since there is little or no transition required, the training in instrument flying is reduced to learning navigation and traffic procedure.

Those favoring symbolic presentation will argue that the advantages gained by any reduction in training will be overshadowed by the additional cost of producing pictorial instruments. As to the actual cost of the instruments, this might be true; but in the final analysis of the overall cost of instruments and training, as well as the savings due to reduction in accidents attributed to pilot error during IFR, the price will be much less.

Most accidents during instrument conditions are due to the confusion of the pilot caused by his being overloaded with too many things to do at a critical time. Most pilots who have flown "on instruments" will admit that at one time or another they experienced panic when several operations had to be carried out almost simultaneously. If the data presented is more comparable to visual flight, it is obvious that there will be only as much confusion as encountered during visual conditions; less confusion, less accidents.

Another factor which is pertinent to the problem of data presentation is the question as to just how far do we carry this pictorial idea. It is apparent that until some means of "seeing through" fog and rain is developed, it would be extremely difficult to create an actual reproduction of visual conditions. We can, however, design instruments which will present the required information in a much more natural way than is being indicated today. Horizons can be made to look like ground and sky with combined motions about the three axes appearing the same as they would during visual flight. Approach indicators can be made to look more like runways with enough change in perspective to more naturally simulate an approach. Navigation devices can look more like the standard aircraft charts.

In the final analysis, the major factor which makes instrument flying difficult is the fact that the pilot's natural environment has been obscured. What he needs is something which resembles these natural cues. Even though he may not use the actual horizon for specific reference, he is always aware of it under contact conditions and his sense of balance is satisfied. If under instrument conditions we can satisfy this same sense of balance, the pilot is at ease as to his attitude and is free to concentrate on the specific information required for navigation, endurance, and his designated mission. Pictorial presentation should be carried out to whatever extreme is required to make the job of flying the aircraft itself a reflex action. The other information required is specific and must be indicated as such.

The ideas shown here are by no means a firm configuration, but are merely to show one concept. There are many ideas as to how instruments should appear, but they can only be considered as personal opinion unless a very careful psychophysiological study is made with pilots and engineers to determine specifically what information is required, what is the most natural way to present this information.

If the presentation more closely simulates the actual visual information, pilot training time can be reduced. If the information requires little interpretation, there is less chance of confusion and hence less chance of accident. With less training and fewer accidents, cost will go down.

Even with autopilots and approach couplers, the machine must still be monitored and the adage still holds—"A picture is worth a thousand words"—or symbols.

[*The opinions or assertions contained herein are the private ones of the author and are not to be construed as official or reflecting the views of Navy Department.*]

PICTORIAL COMPUTER, *like this one developed by ARMA Corp., provides pilot with clearest means of knowing where he is at given time. Position is shown on aircraft chart*

Pilot's Report . . .

(Continued from page 8)

propeller tips and fuselage greatly reduces vibration in the cabin.

7. Last, but by no means least, Lear has filled his "Learstar" with nylon Fuller brushes. These brushes, produced in strips, are installed at every movable surface to reduce what Lear calls "wing nibble" or hinge turbulence and seepage.

Most of these modifications resulted in increments in speed by contributing to aerodynamic efficiency, but it was not until we were at cruise altitude that the total effect of these increments—6 mph here, 4 mph there and 3 mph someplace else—was translated into something really tangible. I mean, of course, greater speed and improved performance.

It is important to remember in discussing performance that instruments do not always mean exactly what they indicate. There always is a margin of error and that error can be so great at times that the information recorded is valueless. I was assured, however, that the fuel flow meter and other instruments had been calibrated shortly before the "Learstar" was flown east for my demonstration flight.

With that assurance, I put my faith in the "Learstar" instruments and turned to the task of determining for myself what the aircraft would do at various power settings. Frankly, I was skeptical of West Coast reports of the speeds established by the airplane. I doubted that the performance of the already clean *Lodestar* could be improved to such a great extent, but once in stabilized flight and with true airspeed pushing close to the 300-mph mark, my attitude underwent a change.

The performance figures set forth in the first two paragraphs of this article set the pattern for what I found and my skepticism slipped away rapidly.

We climbed the "Learstar" out right

TEST PILOT *Herb Fisher and Bill Lear (left) inspect Learstar's retractable tailwheel. This, too, adds speed*

from take-off at 1500 fpm to conform to noise reduction procedures recommended for most metropolitan areas. We then devoted most of our time to running checks on the aircraft at various power settings.

In the low-cruise range, I dropped the rpm to 1840 and manifold pressure to 27 inches. Outside air was about 8° C. At those settings the "Learstar" settled out at an indicated 206 mph, true airspeed of 250 mph and fuel flow of 500 lbs. My notes show that for this run we had a gross of 18,800 lbs. and an altitude of 11,000 feet. At the same altitude, gross and temperature, but with 27.5 inches and 1890 rpm, the "Learstar" indicated 214; true airspeed was 260 mph; and fuel flow was 540 lbs.

I was especially interested in what the "Learstar" would do at 1900 rpm and 26.5 inches at 11,000 feet, because a friend who flies a *Lodestar* had asked me to get a comparison for him. I did. With his *Lodestar* at those settings and altitude, IAS would be around 170 mph; TAS would be in the neighborhood of 208 mph and fuel flow would be somewhere between 525 and 550 lbs.

I set the "Learstar" at 26.5 inches and 1900 rpm at 11,000 feet and temperature was 6° C. True airspeed was 248 mph. The missing links were outside temperature recorded by the *Lodestar* and the slight difference in gross weights of the two aircraft, but even without those variables pinpointed, the speed difference was remarkable.

Most impressive to me was the fact that, with power settings and rpm identical on the airplanes, the true airspeed of the

(Continued on page 42)

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Pilot's Report . . .

(Continued from page 41)

"Learstar" was approximately 40 mph higher—at about the same fuel consumption rate.

On the high cruise side, the example cited in the opening paragraphs of this article is typical for the "Learstar."

Here is a "Learstar" performance table which will supply at a glance typical speeds attainable with this remarkably clean airplane:

MP	RPM	IAS	TAS	F.F. lbs./hr.
27	1840	206	250	500
27.5	1980	214	260	540
30	2100	230	280	640
29	2000	220	268	580
31	2200	234	284	680

These readings were all taken at an altitude of 11,000 feet and outside air temperature of 8° C.

I found the "Learstar" to be an extremely stable aircraft in all flight configurations encountered during the evaluation tests. This stability, always a characteristic of the basic *Lodestar* design, has been improved by the new wing sections, which have wing tips designed to reduce tip vortex to a minimum, and by modifications of the horizontal stabilizer and stabilizer tips.

The "Learstar" I flew was the guinea pig of the conversion program and it recorded the high level of performance listed here despite the fact that it did not incorporate all of the modifications to be included in the prototype and production aircraft. Unlike the production airplane, the "Learstar" I flew did not include the new engine nacelle, which will make for another reduction in drag, increased engine efficiency and improved engine temperatures. The full-closure landing gear wheel well doors had not been installed, nor did it carry the new Swedlow bird-proof windshield. And the streamlining of the new saddle forward of the stabilizer had not been completed.

However, my guinea pig airplane had the benefit of enough modifications to bear out the Lear organization's contention that, through meticulous attention to drag factors rather than through higher horsepower, a basically sound airplane can be transformed into an extra-performance, more efficient vehicle.

Lear's target is a "Learstar" that will cruise consistently at 300 mph or better with a fuel consumption of approximately 110 gallons an hour. Last August the "Learstar" made two cruise runs at 18,000 feet between Santa Monica and Catalina Island. On one of them, it attained a mark of 301 mph using 57½% of rated METO engine power. It is obvious that cruise figure will be materially bettered in "Learstars" powered by the Wright 1525-hp C9HE engine.

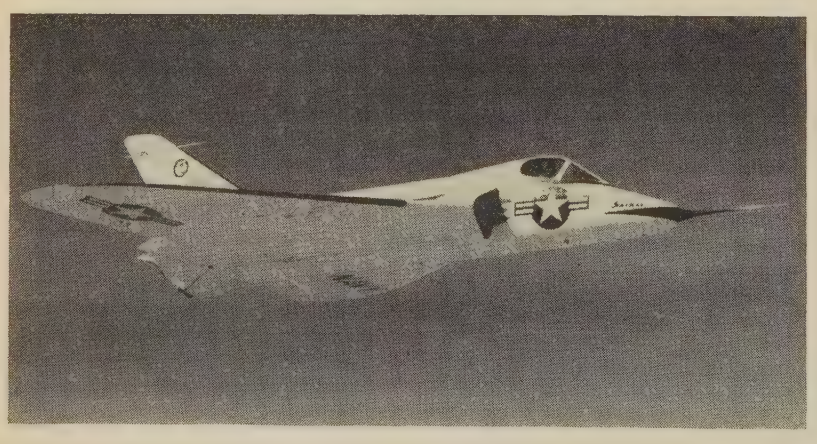
Right now, Lear Conversions, Inc., is guaranteeing 270 mph true airspeed as the cruise figure for the production "Learstar." I have a suspicion that the figure will be upped before Number Three airplane rolls off the line.

Still another aim of the Lear conversion program is a seat-mile cost in the neighborhood of three cents a mile. That figure is predicated on an average speed of 270 mph for a 10-seat "Learstar" with a minimum yearly operating time of 1,000 hours. Cost per airplane mile, based on annual mileage of at least 270,000 miles, is figured at about 34 cents. A more detailed picture of estimated operating costs for the "Learstar" will be found in the table accompanying this article.

To sum up, Lear is offering the private air travel market a *Lodestar* converted to the following "Learstar" specifications: 270 mph and up, true airspeed, at 10,000 feet and at not more than 740 hp per engine; maximum range in excess of 3,000 miles, exceptional pilot visibility; spacious, deluxe cabin comfort; low seat-mile cost; dependability and safety. I find it hard to believe, too, but on the basis of my flights in the experimental "Learstar" I have no doubt that virtually all of those guarantees should be met in the completely modified airplane.

If this report on my flight with the "Learstar" reads like the garbled notations of a pilot suffering from a bad case of vertigo, I'd like to quote Bill Lear: "Don't take my word for it. Fly it yourself." ✈

	YEARLY OPERATING TIME			
DIRECT HOURLY COSTS:	300 hrs.	500 hrs.	700 hrs.	1000 hrs.
Gasoline – 110 Gal/hr @ 40¢	$ 13,200	$ 22,000	$ 30,800	$ 44,000
Oil – 1 Gal/hr @ $2.00	600	1,000	1,400	2,000
Airframe MOH @ $2/hr	600	1,000	1,400	2,000
Engines MOH @ $6/hr	1,800	3,000	4,200	6,000
A&E Maint. @ $5/Hr	1,500	2,500	3,500	5,000
L'D'G Fees & Misc. $1/Hr	300	500	700	1,000
Crew Travel Exp @ $2/Hr	600	1,000	1,400	2,000
Total Annual Direct Cost	$ 18,600	$ 31,000	$ 43,400	$ 62,000
Direct Cost Per Hour	**$62**	**$62**	**$62**	**$62**
FIXED ANNUAL COSTS:				
Storage @ $75/Mo	$ 900	$ 900	$ 900	$ 900
Depreciation	(if any, depends on current market)			
Pilot & CoPilot Salaries	17,500	17,500	17,500	17,500
Total Fixed Annual Cost	$ 18,400	$ 18,400	$ 18,400	$ 18,400
ANNUAL INSURANCE:				
*Hull – All risk, ground & flight, incl. $1,500,000 single limit aircraft liability – bodily injury, P.D., Passenger Liability and $50,000 per seat admitted passenger liability	$ 10,995	$ 10,995	$ 10,995	$ 10,995
TOTAL ANNUAL COST	$ 47,995	$ 60,395	$ 72,795	$ 91,395
Total Cost Per Hour	**$159**	**$121**	**$104**	**$91**
MILEAGE COST:				
Miles (Average speed of 270 MPH)	81,000	135,000	189,000	270,000
Cost Per Airplane Mile	**.59**	**.45**	**.39**	**.34**
Cost per Seat-Mile (10-Seat Interior)	**.059**	**.045**	**.039**	**.034**



DOUGLAS F4D *is Navy's newest carrier-based jet interceptor. Piloted by LCDR. James B. Verdin, it set a speed mark of 753.4 mph at Salton Sea, California*

KLM's Super Connie

(Continued from page 13)

airplanes use a constant indicated airspeed system for cruising, facilitating the control of the airplane as well as navigation and flight planning. For the L-1049C, 230 mph dial IAS is used, which at 23,000 ft. results in 287 knots TAS. For stages where range is critical, the IAS may be decreased with gross weight by 1 mph for every 1,000 lbs.

During the initial flight-test of the L-1049C, various changes had to be incorporated which have caused some extra drag on the airplane. It was not possible to rework the airplane before delivery, because KLM required their "Super Connies" in order to cope with the huge traffic demand of the top season. However, KLM and Lockheed agreed to leave the test airplane at Burbank, enabling Lockheed to study the most efficient way of incorporating the changes in the design.

The information now available on the results of this drag-reduction program is very satisfacory, even to the extent that drag reduction has been achieved on items which had not been changed during the flight test. Consequently, Lockheed is confident that eventually the aircraft drag will be reduced to the original values.

For the time being, the extra drag is compensated for by using slightly higher power, thus flying at the original speed with a temporary penalty in fuel consumption.

AUTOPILOT: The PB-10 autopilot includes automatic altitude control which keeps the aircraft within 15 feet of a preset pressure altitude. This automatic altitude control is much more efficient than the old longitudinal control; it reduces variation in airspeed and increases safety.

Due to the combination of an inherently more stable airplane and the improved autopilot, it was possible to reduce the minimum comfortable speed by 10 mph IAS, which in some cases resulted in lower fuel consumption, especially for flights with tailwinds and during holding procedures.

HEATING AND REFRIGERATION: Compared with the L-749, the output of the cabin air compressors is increased by about 100%, supplying 70 lbs. of fresh air every minute at a maximum pressure differential of almost 11 inches of mercury, which maintains sea-level cabin pressure when flying at an altitude of 12,000 ft., and which keeps the cabin altitude down to 8,000 ft. when the aircraft is flying at 24,000 ft.

Due to the high output and pressure of the compressors, heating of the cabin is required only when flying in very low ambient temperatures. For operation in hot climates, the pressurized air is passed through intercoolers and an expansion turbine before entering the cabin. Cooling air for the intercoolers is obtained by opening air intake ducts on the under-surface of the wing.

The cockpit has its own temperature control which is completely separate from that of the cabin, thus eliminating the difficulties encountered in other aircraft types where cockpits are too hot or cold.

Some other interesting features of the *Super Constellation* are:

AUXILIARY ENGINE-OIL SYSTEM, permitting oil transfer to any engine tank from one reserve tank. By having the flight engineer replenish all engine tanks just prior to landing, topping off the oil may be accomplished simply by refilling the reserve tank, thus reducing ground delays.

IMPROVED DE-ICER BOOTS cemented to the wing skin and operating under high pressure. This system has been successfully tried out on all-weather fighters.

IMPROVED SAFETY through more emergency exits including full-size forward freight door, improved fire walls, and easy-to-operate emergency fluid shut-off system.

BUILT-IN FUTURE GROWTH to 150,000 lbs. gross weight and turboprop installation which will propel the aircraft at a speed of not less than 420 mph.

Since August 15, the new airliners have been on scheduled passenger service on the KLM routes to New York, and passengers to South Africa have been enjoying the luxuries of the *Super Constellation* since October 4. At the end of this year, the ninth *Super Constellation* will be delivered, and four more are to be added to KLM's growing fleet in 1954. By then, *Super Constellations* will be introduced first on the routes to Curacao and to Rio de Janeiro, Buenos Aires and Santiago, and after that on the Far Eastern network extending to Djakarta and as far as Tokyo.

KLM expects that the new planes will prove a major attraction to the traveling public for the next years to come. +++

Model

PERFORMANCE!

You can relax now — Santa Claus will NOT get lost
hunting your chimney Christmas Eve. On instruments like these,
he could salvo his baggage down a piece of macaroni!
For this reassurance, we can thank Dallas Secretary Alice Gunn who
solved the problem of what to give a guy who's got everything,
by giving him a custom-designed Southwest Airmotive instrument
panel, its components scientifically calibrated, balanced,
and tested on the latest Eclipse-Pioneer-approved equipment.
If Santa is the curious type and wants a peek at the backside,
he'll find the panel plumbed and wired for quick, easy removal.
If, on the other hand, he wants to swap the panel for
Alice Gunn, we can only tell him she's 21, blonde,
blue-eyed, 118 pounds, and 5' 6". From there, he's on his own!

Southwest Airmotive COMPANY
LOVE FIELD | DALLAS

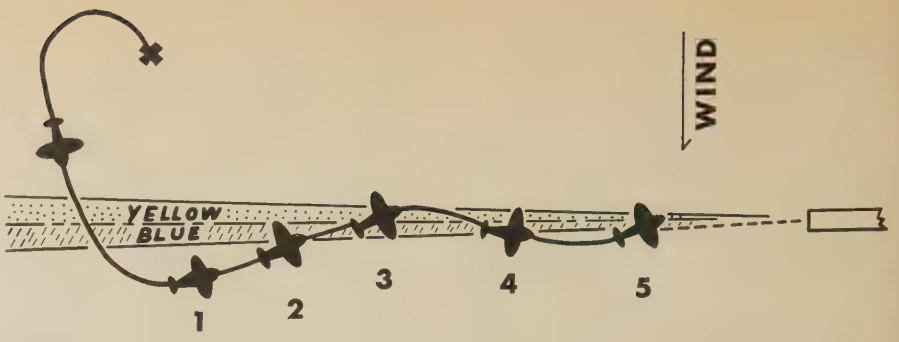
Wilcox "C A T"

(Continued from page 16)

able to fly the localizer right down to the end of the runway. The wind was easterly and variable. After Bob became a little familiar with the airplane and the use of the Computing Automatic Tracker, we blocked off the directional gyro and compass so that he would have only the ILS deviation needle to use in keeping lined up on the localizer course. The first of these approaches was made from an 80° reversement turn to the 184° localizer beam. (This is not a standard ILS procedure, but it offered the most expeditious method when the Tower was able to clear us for the simulated ILS approach.) Bob turned through the localizer beam to a magnetic heading of 180°.

The Wilcox Beech is equipped with both a CAT and a standard ILS indicator for comparative purposes. The subsequent heading corrections, and corresponding needle deflections to the left or right, expressed in dots from neutral were as follows:

	Needle Deviation	
Airplane Heading	*Cat*	*Standard*
1. 180°	5 L	2 L
2. 164°	0	2 L
3. 170°	1 R	0
4. 186°	5 L	2 L
5. 174°	0	1 L



SKETCH *shows the plan's relative position along the localizer beam, and the airplane headings at time the readings (see listing in outside column of text) were taken*

The diagrammatic sketch (above) shows the airplane's relative position along the localizer beam and the airplane headings at the time the readings were taken. Comparison of the tabulations with the sketch will show that in each position the CAT told the pilot what to do to get on the center of the localizer beam and stay there, while the Standard ILS needle told him only the airplane's position relative to the center of that localizer beam. Notice that in position No. 5 the airplane is holding slightly downwind of the center of the localizer beam, but will continue to hold that relative position to the runway. The pilot is in a good position to make a landing from that approach. The 174° heading was held to the runway without the use of a directional instrument and with only the CAT needle for reference.

The next two approaches were made with only two or three major corrections and clearly indicated that Bob already had the knack of flying the CAT. Since he was doing this without the aid of a gyro or a compass, it was obvious that there was little to be gained by further such runs.

After using the CAT and discussing its improvement over the standard ILS, the logical question was—why put a $495.00 device in the airplane if four times that amount must be spent to get airplane heading information to feed into that device? For every airplane equipped with a C-2 or C-4 compass, there are 10 business and airline airplanes flying without any means of supplying electronic direction sensing.

I was invited to the Wilcox plant, where Bob Lee of the Sales-Engineering Department showed me the factory. We spent considerable time in the Research and Development Laboratories. A unit is under development which will make any ILS-equipped airplane easily modifiable to the CAT at relatively little extra cost. This is an electric sensing unit directly connected to a directional gyro.

To take directional sensing from a gyro compass without increasing torque is no easy problem, but Wilcox has accomplished this in the experimental laboratory. It is now undergoing service tests in the company airplanes and gives every indication of being a success. The unit, including a small inverter, weighs only three pounds more than a standard DG. It will sell for approximately $600.00. The modified directional gyro with a coupled sensing unit should be available in a production model early in 1954.

I have been assured of an opportunity to examine and to flight test a production model of the Directional Gyro Sensing Unit, and will report on it at a later date.

Wilcox Computing Automatic Tracker improves on the functions of the ILS indicator system. It shows the pilot *where he is going* with reference to the localizer beam rather than *where he is* at that particular moment. With use, pilots learn the idiosyncrasies of each Instrument Low Approach System. Pilots of business and executive aircraft who are making ILS approaches to unfamiliar airports can do no anticipating. To them the CAT should offer particular appeal.

CESSNA 170 *for 1954 was announced recently by Cessna Aircraft at Wichita. Paralleling this announcement was word of $155 reduction in the standard-equipped 170's factory delivered price. Airframe configuration of the new '170 and its flight characteristics have not been altered, but the airplane does feature two new color combinations. The shock-mounted instrument panel features a non-glare finish, and recessed mountings are provided in the standard panel for eight additional instruments plus two radios. The 170 is powered by 145-hp Continental engine, coupled with a McCauley propeller, and has 4½-hour range*

Skyways Round Table

(Continued from page 21)

an indication of how important it is to have shelter. A shelter is one of the prime considerations for cold-weather operations. For sustained operations in extremely low temperatures at an Arctic station, you have to have a heated hangar. You should be able to pre-flight in that hangar, and get out and get going directly from the hangar. You'd also have to have humidity control."

A. E. Ades: *"Is the military giving any consideration to induction air heat or carburetor heating?"*

Col. Balchen: "At the present time as far as we are concerned, the heat that we have in our carburetors is sufficient for effective operations. I don't believe we have had any cases of carburetor icing of serious consequences on take-offs for the past five or six years. It was a serious problem five or six years ago, however."

A. E. Ades: *"Do you still use alcohol?"*

Col. Balchen: "Yes, on certain types of engines."

T. D. Allegretti: "At a reported 30° below, we've noticed our cylinder head temperatures drop down to 175°."

Col. Balchen: "When you have extremely cold temperatures up above, you have to watch your landing. Your head temperatures will drop out from under you."

T. D. Allegretti: "We have encountered and are still encountering carburetor ice problems. With the R2800 on the DC-4 we get carburetor ice. We've added another baffle to our air scoops to try to get more carburetor heat."

D. F. Coyne *(General Foreman-Maintenance, Flying Tiger Line):* "We haven't had any trouble with head temperatures on our '4's. We do operate P & W R2800-75's which are pretty critical on head temperatures at times. As far as icing goes, we don't have any major problems in flight."

J. Lederer: "I'd like to ask Col. Balchen a question. In addition to the equipment soaking up the cold and causing an increase in the amount of time to get things operating, does the cold cause any equipment failures?"

Col. Balchen: "Yes, in many cases it causes failures both in instruments and in powerplants several hours after take-off. Many times it makes the whole Arctic operation very unpredictable."

T. D. Allegretti: "We have found some help for that problem as far as instruments, especially the air vacuum instruments, are concerned. We are now taking our air off the heated part of the airplane . . . right out of the heated ducts and directly into the instruments. This has helped not only on days with freezing temperatures but also on moisture-laden days when our filter became saturated."

Capt. Cahill: "I think Northwest was one of the first to encounter types of carburetor icing other than throttle ice, to the extent that we have completely equipped our DC-4 fleet with fuel-flow meters, the only available instrument for DC-4 installation to give an indication of other types of ice. We educate all our flight crews to interpret engine indications in terms of carburetor icing. On our Boeing aircraft we have torque meters, fuel-flow indicators, etc., that we use to diagnose the possibility of an engine malfunctioning because of carburetor ice.

"We also have one other problem that hasn't been touched on here as yet, and that's oil cooler congealing. We have that to the extent that we do not believe in automatic control of oil temperature in extremely cold weather. Because temperature sensing does the reverse of what you want it to do with a congealed oil radiator —it calls for opening the shutters if the oil temperature goes overboard—the proper thing to do is to close the oil cooler shutter doors if the temperature rise was due to congealing."

R. T. Peters: "The R 3350 engine which powers our *Constellations* employs the pressure type of carburetor which has been susceptible to what is known as water ingestion. Probably due to scoop effect, the water which is ingested into the induction system freezes in the impact tubes which are a part of the pressure-metering and sampling of mass air flow

(Continued on page 46)

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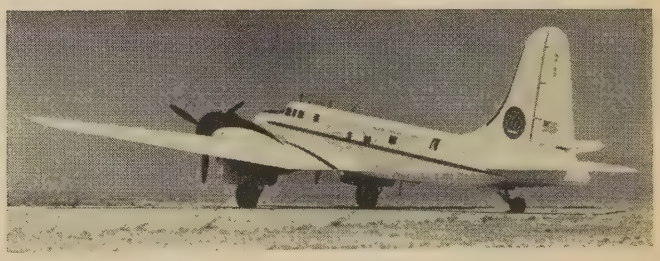

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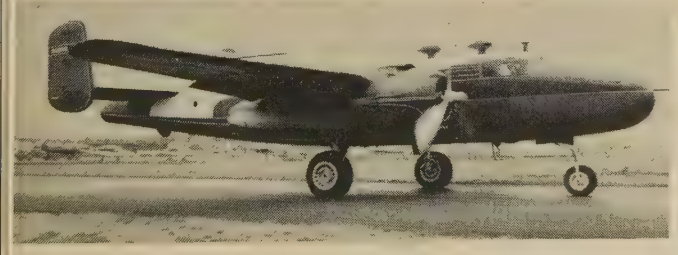

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Skyways Round Table

(Continued from page 45)

through the induction system of the engine. Once the impact air or this A chamber air is disturbed or restricted in any way, you get erratic engine operation. The answer to that was to provide an alternate source of this A chamber or impact air. We installed a switch-operated solenoid valve which takes impact air in from the oil cooler scoop. If there is any indication that we are experiencing water ingestion and freezing in the impact tubes, the flight engineer flips the switch which gives him an alternate source of this impact air, and then he plays the fuel flow by opening or closing the oil cooler door which varies the A chamber pressure in the carburetor. All this, of course, is prevalent only in our *Constellations*."

Wing Covers

T. J. Healey: "I'd like to ask the operators to what extent they are using wing covers."

W. W. Mies: "We have done away with them almost completely. If it's wet, the wing covers will freeze to the wings and you can't get them off. If the snow is dry, you don't need wing covers because the snow will blow off anyway."

A. D. Ades: "*Trans-Canada is still using wing covers and we are programming the development and building of wing covers for our future aircraft, up to and including the* Viscount *turboprop airplanes. I find it very interesting that you have been able to drop them.*"

T. J. Healey: "We haven't dropped them entirely, but their use has been reduced materially in the past five years."

J. H. O'Neill: "I agree that many times they are a lot more trouble than they are worth, but there are circumstances where there is nothing else that will do the job for you. While they are a lot of trouble to put on and take off, they do let you operate when you can't get any shelter. You'd be out of business without them."

T. J. Healey: "There's one thing in the use of wing covers that should be borne in mind. The problem is not merely one of putting the covers on and taking them off, but today's aircraft have fuselages of such size that you have to take into serious consideration the problem of how you are going to remove the ice from the fuselage. That is fast approaching the seriousness that the wing-ice problem did a few years ago."

J. Lederer: "What happens when you pull the wing covers off and the airplane has to sit out on the end of the runway while you wait for other planes to land? Snow accumulates on the wings, and what do you do about it?"

T. J. Healey: "You don't pull the wing covers off until you've received your take-off clearance."

T. D. Allegretti: "We send men right out to the end of the runway and they pull the covers off at the last minute. It takes a lot of manpower putting the covers on and taking them off, but we operate more with them than we could without them."

J. H. O'Neill: "As Mr. Healey of American Airlines brought out, you simply have to spread your schedules so that you can devote a certain amount of extra time to each trip. If you don't schedule trips that way, you'll get all bound up and nothing will work. I might add that it's rather embarrassing to get down to the end of the runway and then find that you can't take the wing covers off because they are frozen on."

W. W. Mies: We've found that a coat of glycol, sprayed on when the aircraft is on the ramp, will last quite a period of time. That eliminates the removal of wing covers at the end of the runway."

J. Lederer: "A recent NACA report confirms the seriousness of this ice-on-the-wings situation. For some reason or other, there is more of that at some airports than at others."

Col. Balchen: "Ice on the wings is very critical on our new and larger jets. It's a more serious problem than it has ever been."

A. E. Ades: "*It has been our policy at Trans-Canada not to dispatch any airplane that has ice or frost on the wings. We cancel out the flight.*"

T. J. Healey: "That's American's policy, too, but it's pretty hard to tell a passenger that an airplane can't fly because it has a small amount of frost on it. There certainly isn't anything you can do about it, however, except to remove it."

***"FUEL-FLOW** meters on DC-4," said Capt. Cahill, "gives indications of other icing"*

***"WATER** ingested into induction system," reported R. T. Peters, "freezes in tubes"*

Water Systems Icing

A. E. Ades: "*Let's throw the meeting open now to leading edge de-icing, water systems, hydraulics and materials.*

"*Mr. Eischeid, what is your opinion of the relative merits of the high-pressure thermal boot de-icer vs. the hot wing?*"

Capt. J. O. Eischeid: *(Mgr.-Flight Atlantic Region, Trans World Airlines):* "TWA has found both systems to be satisfactory."

T. J. Healey: "From a maintenance point of view, in our more than five years experience with the Convairs and DC-6's, we have been very much satisfied with thermal wing de-icing. We think it's far superior to any other device thus far.

"We feel that with the combination of thermal wing-de-icing, NESA windshield de-icing, electric heated propeller boots, alcohol de-icing aids and ample carburetor heat that we have on the Convair, and the ability to use Icex as an emergency reserve, we're better equipped today than we've ever been for winter flying."

Capt. Steers: "It's interesting to listen to our radio when you have two types of aircraft operating in an area where icing conditions prevail. The pilots in the DC-3's usually are busy singing a song of woe, while there is no word at all from the Convair pilots. The boys in the Convair cockpit are well satisfied with the wing heat and the electric boots on the props."

A. E. Ades: "Capt. Steers, would you comment on water-system problems?"

Capt. Steers: "Since we are a short haul operator, we do not have too much of a problem, being able to drain the systems and carry sufficient water in thermos jugs. A long-haul operator would be more qualified to speak on this problem."

J. E. Conner: "Since we're getting DC-6's, I'm curious as to how the flushable toilets work in the winter. That's a serious problem with us. How do you keep them going? We have a lot of money invested in them and it looks as though we'll have to throw them away and go back to chemical toilets."

J. Lederer: "I'd like to know what the solution is to this whole matter of vents on the side of the ship, vents that water comes out of. What can keep the water from coming out, freezing and falling off in chunks?"

R. T. Peters: "There have been some experiences along those lines, particularly on *Constellation* equipment. With a sump tank which drains the wash-water basins and then drains it all overboard from the aft belly of the airplane, it has been reported that pieces of ice accretion have collected at that location. The approach to that problem is one Lockheed is working on and flight testing, and it will probably be ready for installation sometime during the winter. It is a polyethylene type of overboard vent or drain tube which will drain the water an appreciable distance away from the airplane, a greater distance than we have now with the flush-type drain. In this interim period, however, we are polishing the belly area

of the plane just aft of the drain and applying a solution of Icex to prevent the accretion."

J. E. Conner: "Is Lockheed now designing a heated exit for the wash-water outlet?"

R. T. Peters: "That has been discussed. However, I don't know how far it has developed."

T. J. Healey: "Our experience with long-haul aircraft such as the DC-6 has been disappointing with respect to water lines. In real cold weather there is hardly a trip that doesn't end up with one or more lines frozen. We had to completely campaign the airplanes, from A to Z and from nose to tail, because there are so many traps in the system.

"One thing we did was to make more use of vinyl plastic tubing because the chances of it bursting or failing are a lot less than the standard aluminum line. We reworked our DC-6's this way and this past winter our operation materially improved."

R. T. Peters: "We have always had trouble with freezing wash-water systems. When our 749-A's were built, we utilized as much pliable rubber tubing as we could.

"Corrosion is another problem. Having to use water from all over the world, the water faucets become so badly corroded they won't work."

A. E. Ades: *"Commander Weatherup, would you review for us the Navy's program on materials affected by cold weather."*

Cmdr. R. A. Weatherup *(Head of Mechanical Equipment Design Branch, USN):* "The Navy along with the Air Force has an extensive test program for developing and proving standard fittings and components. These standard fittings and components appear in commercial aircraft as well as the military. Also, our complete airplanes undergo tests in the cold-weather hangar at Eglin Air Force Base. All of this means our equipment is well tested before it is delivered to the fleet.

"Going back to standard components, we are in a continual battle with our manufacturers regarding standard equipment. Many progressive companies are in the foreground in the development of lighter equipment than is currently available in standard types. I'm in complete agreement with their aims and can assure you that the standards are constantly being revised as better equipment is developed.

"The Navy is active in the field of testing new materials for seals, hydraulic components, etc., in our different laboratories, and our aim is to come up with better standard components for military use."

A. E. Ades: *"Do you feel that the present lower limit of temperature requirement, approximately -°60 F. is sufficiently low to warrent carrying on in development this varied equipment in the new aircraft, or should it be lowered?"*

Cmdr. Weatherup: "In the hydraulic field, and I suspect it's true in other fields, too, if we drop that to -70°F we will be certain to run into trouble in the higher operating temperatures. There is a limit to which the scientist can expand his range of operation. I feel we'll get the best weapons by stopping about where we are on the lower end of the scale, and resorting to liberal use of heat and hangars for cold-weather operation."

J. Lederer: "I'd like to know something about the fire hazards involved in refueling while you're using your heaters on the outside of the airplane."

A. E. Ades: *"With reference to our 'Northstars' in cold weather on the ground, we operate the aircraft heaters continuously. We do that, however, only under two conditions: 1) we have a pogo-stick DB principle of wire screen that goes over the exhaust outlet, and 2) we have what we call an elephant-trunk lead-in for combustion air and cabin air. This is about 30 feet long and is taken up-wind of the airplane, well away from the aircraft. We've done this for the past four or five years and we've experienced no difficulties whatsoever.*

"We do not operate the DC-3 heaters. While they're the same type of heater as the Janitrol, the exhaust is immediately over the wing, and we feel that it creates a hazard. We've attempted to design a screen outlet for that, but we haven't been too successful.

"We'd rather operate a heater in the aircraft than try to operate a gasoline-burning heater on the ground and attach it to the aircraft. We feel it's safer."

J. Lederer: "Do you carry survival equipment for your passengers?"

A. E. Ades: *"TCA does not."*

J. Lederer: "Do you have any trouble with ice forming on the inside of your windshield?"

A. E. Ades: *"Not with TCA."*

J. H. O'Neill: "The problem in the DC-4 has not been ice but fog in letting down in wet weather. Even in the summertime, we've found that we had to use cockpit heaters on the windshield, and it gets pretty uncomfortable. As far as ice on the inside of the windshield is concerned, we haven't had that."

Cmdr. Weatherup: "The problem of guns in fighter aircraft is a real one. If you put in gun heaters, you solve the problem but you add weight. An interesting point is that gun trouble does not usually occur on your first hop in the morning. It occurs on the second. The theory is that when you take off on your first flight in the morning, the guns get chilled and then when you come on back down to the moist air at sea level, the guns collect moisture. Unless they are taken out and carefully serviced again, you run into trouble on the second hop.

"I'm wondering if the airlines have any equipment of a similar nature that develops that kind of trouble?"

A. E. Ades: *"Water systems are all that I can think of that might be associated with that or perhaps micro-switches."*

J. Lederer: "Do you have any trouble with brakes freezing?"

A. E. Ades: *"We did until we took the disc covers off. The covers would collect snow which would melt and then refreeze. Beyond that we've had no trouble.*

"As you probably know, we had a Viscount over for winter trials last year, and we found that the anti-skid device that

(Continued on page 50)

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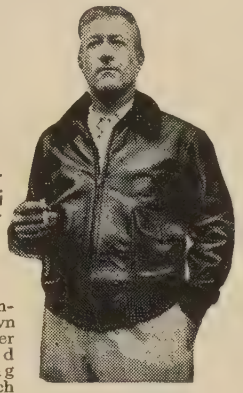

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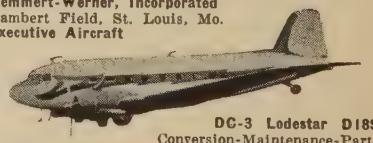

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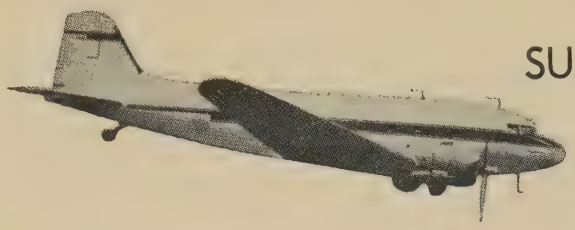

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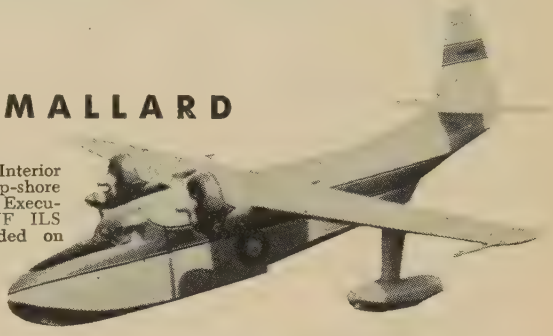

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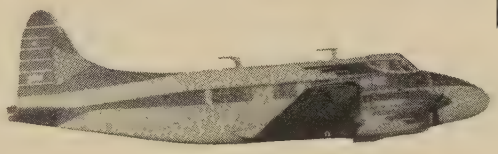

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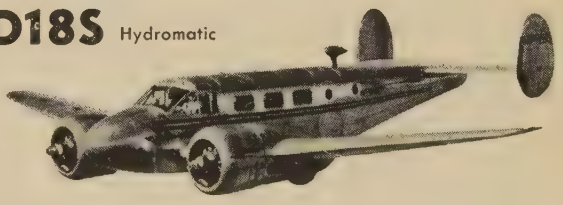

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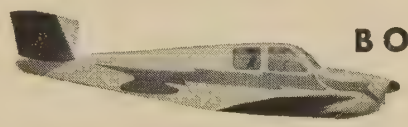

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Skyways Round Table

(Continued from page 47)

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"One subject we haven't touched on, gentlemen, is that of communications. Our communications in Canadian operations are sometimes rather seriously affected by the Northern lights which are associated with cold weather operations. Col. Balchen, would you tell us something of your experiences in that direction?"

Communications Black-Outs

Col. Balchen: "We have all kinds of headaches with communications equipment in high-latitude flights. We have what you refer to as Aurora Borealis affecting communications, but that is not the primary cause. At the Univeristy of Alaska they have been conducting some very interesting investigations in upper layers, and they are giving us forecasts on electronic blackouts. These blackouts seem to be related to an entirely different phenomenon than Aurora Borealis. They seem to be related to shifting Ionospheric layers. When we get into those regions which we call 'Far North,' we have absolute communications blackouts over long periods. When you start operating transport routes up there, you will experience those blackout areas too. We hope, for the sake of your future operations up there, that we'll have most of those problems solved by the time you are ready.

"We can remedy quite a lot of it in the ultra high frequency ranges maybe with high power at the ground stations for the medium frequencies or maybe the scientists will devise some other ways to put the communications through. But it is very sad as far as we are concerned today. It has amounted to cancellation of flights, flights from Alaska to the North Pole and back, and from Greenland to Alaska and back. You just can't get anything through.

"I had an experience in 1942 at BW-8. An electronic blackout lasted three weeks. We couldn't get anything in or out on any of our regular channels. You'll run into this when you get your transport routes up through there."

A. E. Ades: *"Is it possible to predict with any degree of accuracy when these blackouts will occur?"*

Col. Balchen: "As I said before, the University of Alaska is doing magnificent work in forecasting these electronic blackouts. They have reached a point now where they can give you the degree of blackout on the day of the blackout, say 50% blackout and then 100% blackout."

T. J. Healey: "What area would these blackouts cover?"

Col. Balchen: "It generally covers the

(Continued on page 52)

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Skyways Round Table

(Continued from page 50)

area north of the Brooks Range and over the Canadian Archipelago. It covers most of Greenland down toward BW-7, and it covers part of the Arctic Norwegian Sea to the North Pole. It covers the Arctic area down to the Davis Straits."

J. Lederer: "Is that true of the Antarctic, too?"

Col. Balchen: "Yes. This phenomena seems to be associated with atmospheric layers located at the Poles."

R. L. Stacy: (*Asst. Director-Operations, TWA*): "Is this a seasonal proposition?"

Col. Balchen: "No, we have it all year 'round. We have a seasonal problem in our twilight barriers which, in the high latitudes, we have just prior to the midnight sun interval. We have some twilight barriers to cross when entering the Arctic regions. We have long twilight areas in the spring and fall in high latitudes which block out our radio and prevent celestial observations. We need radar."

A. E. Ades: *"May I just summarize our discussion and draw a few conclusions from the items we have covered today.*

"Most troubles relating to winter operations and the effects of reduced ambient temperatures on aircraft can be categorized in two main groups. These two embody the problems encountered while the aircraft is in flight, and the problems encountered while the aircraft is on the ground. We all seem to agree that, for the most part, the in-flight problems are subordinate to those on the ground.

"It would appear that one of the major in-flight problems is the tendency of oil coolers to congeal and subsequently fail. This is a problem with which we in TCA have been closely associated. I gather, however, from our discussion that those of us who have this problem have been able to devise and adopt means and methods of circumventing this difficulty.

"The major ground handling problems relate to the effects of very low ambients and associated wind chill on the aircraft, the men working on the aircraft and the handling of passengers. We seem to have reached a common solution in our methods of keeping the passengers happy under adverse weather conditions. Direct aircraft dispatch from the hangar seems to be the most practical and simple solution.

"While the problems of very low ambients and severe wind chill have not yet directly affected the commercial operator to any great extent, they have both been very real problems to the Military. With the advent of Global Polar Path Commercial operation, these problems are going to be at the doorstep of many airline operators. It is essential, therefore, that we take every advantage of the great wealth of experience and technical information presently being gained by Military Arctic Operations. I will leave you with this thought in the hope that we now have a better appreciation of each other's problems and what is being done about them."

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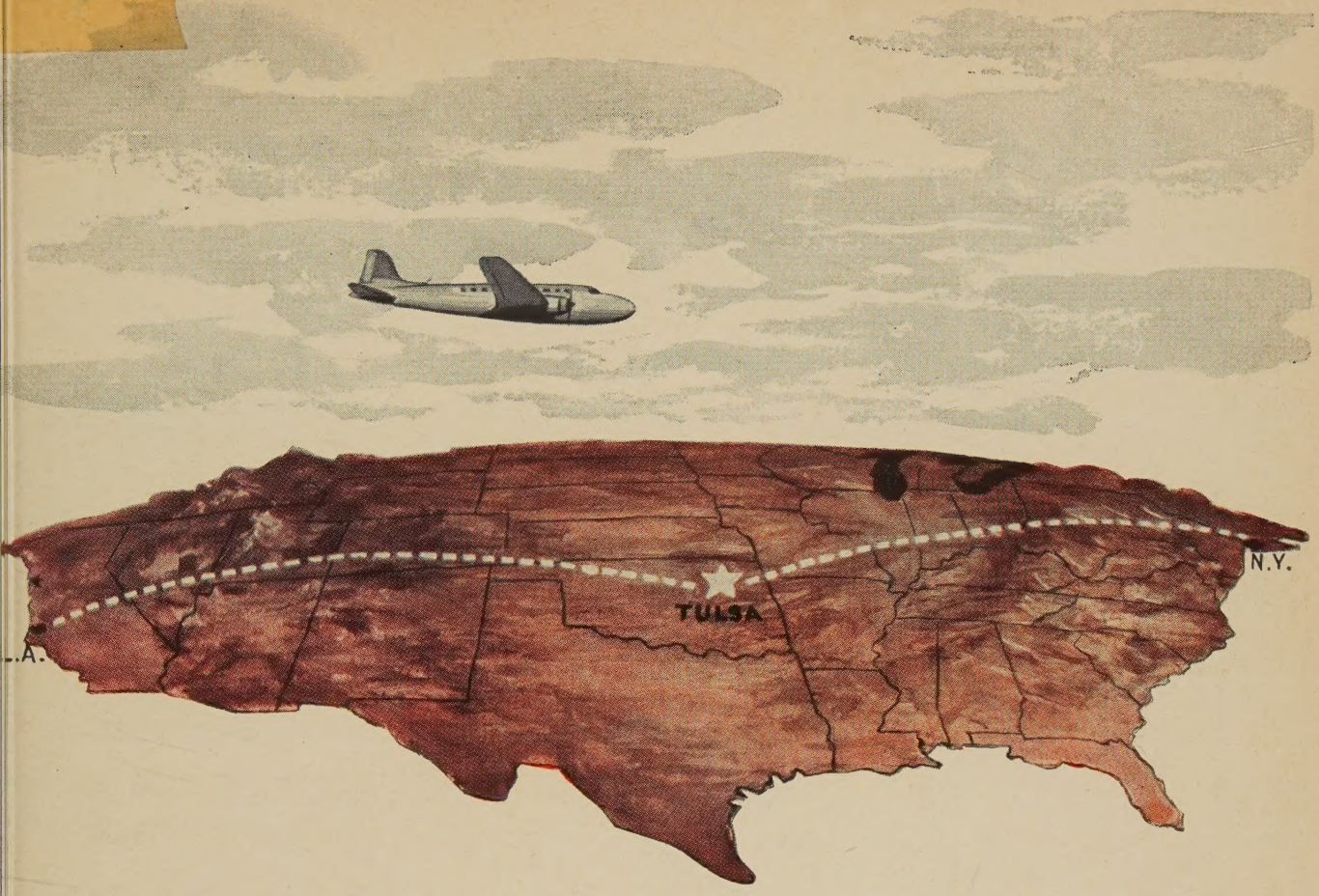

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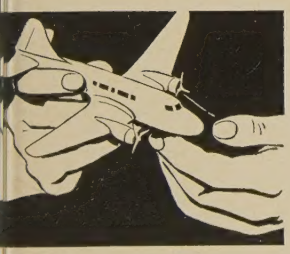

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